Vol. 32 No. 4

BULLETIN

OF THE

TORREY BOTANICAL CLUB

APRIL, 1905

New or noteworthy Hepaticae from Florida

ALEXANDER W. EVANS

(WITH PLATE 5)

The following notes are based almost entirely on three collections of *Hepaticae* from southern Florida, recently made under the direction of the New York Botanical Garden. The majority of the specimens were gathered in the region south of Miami. Dr. Small has already called attention to the physiographic peculiarities of this district and has commented upon the intimate relationship which exists between the higher plants found there and those native to the West Indies.* The *Hepaticae* bring out the same relationship; more than half the species in the collection have also been found in the West Indies or in other parts of tropical America, and the others find their closest allies among species from these regions.

The collections embrace only twenty-one species in a condition to be identified; three of these, however, are apparently undescribed, and six of the others are here definitely recorded for the first time from the United States. Nine species, therefore, are new to our hepatic flora. The remaining species, all of which have previously been collected in Florida, include one *Riccardia* (*R. pinguis*), one *Plagiochila* (*P. ludoviciana*), one *Radula* (*R. australis*), seven *Lejeuneae* (*Microlejeunea lucens*, *Lejeunea americana*, *Cheilolejeunea phyllobola*, *Euosmolejeunea duriuscula*, *E. opaca*, *Brachiolejeunea corticalis*, and *Mastigolejeunea auriculata*) and two species of *Frullania* (*F. Kunzei* and *F. caroliniana*). The additions to

* Jour. N. Y. Bot. Gard. 5: 49–53. 1904.

[The BULLETIN for March (32: 123–177) was issued 19 Ap 1905.]

our flora include two representatives of the *Epigoniantheae* and seven *Lejeuneae;* they are as follows:

1. **Plagiochila Smallii** sp. nov.

Bright- or dark-green, loosely tufted: stems rigid, varying in color from green to yellowish or reddish, 0.35 mm. in diameter, composed of about three layers of thick-walled cells around a central cylinder of thin-walled, colorless cells, all the cells except those of the outermost layer more or less elongated; stems sparingly and irregularly or subdichotomously branched, the branches oblique, similar to the stem but often with smaller leaves: stem-leaves distant, spreading at an angle of 45–60°, narrowly ovate to ligulate, maximum length about 3 mm., width about 1 mm., shortly decurrent both antically and postically; antical margin straight or nearly so, plane or narrowly revolute, especially near the base, entire or with one or two small teeth in outer part; postical margin straight and parallel with the antical margin or slightly curved, revolute near the base, bearing two to six teeth in outer third, otherwise entire; apex broad and usually truncate, bearing two to four teeth; all of the teeth acuminate, the largest (in the apical region) six to ten cells long, three to seven cells wide at the base, and ending in a row of two or three cells: branch-leaves similar to the stem-leaves but usually with fewer and smaller teeth: leaf-cells plane, averaging 29 × 16 μ at the margin of the leaf, 37 × 23 μ in the middle, and 46 × 25 μ at the base; cell-walls thin but with distinct triangular trigones and occasional intermediate thickenings; cuticle slightly thickened, smooth: underleaves rudimentary: inflorescence dioicous: ♀ inflorescence borne on a more or less elongated branch, usually without an innovation; bracts in one pair, similar to the stem-leaves but usually a little broader in the basal region and with a few more teeth along the postical margin, 2.5 mm. long, 1.2 mm. wide; perianth (of unfertilized inflorescences) somewhat compressed, campanulate, 1.2 mm. long, 1 mm. wide, shortly bilabiate at the mouth, each lip bearing about twenty slender teeth, the majority of them being six to twelve cells long and two cells wide at the base; wing along the antical keel entire and very narrow, found in the basal region only: ♂ inflorescence and mature sporophyte not seen. (PLATE 5, FIGURES 1–8.)

In hammocks near the homestead trail, between Cutler and Camp Longview (*Small & Carter 1376, 1411*). In everglades near the unfinished railroad grade, between Cocoanut Grove and Cutler (*Small & Carter 1388*). Breckell's Hammock (*E. G. Brit-*

ton 87). In everglades near Camp Longview (*Small & Wilson 1520*). *No. 1411* may be designated the type.

The leaf-cells of *P. Smallii* are somewhat variable with respect to the size of their trigones; even when very small, however, these structures can be easily demonstrated in leaves which are spread out flat. In some specimens the trigones and intermediate thickenings are more or less confluent, and this is especially likely to be the case along the inner side of the marginal cells, where the walls often present the appearance of being uniformly thickened (FIGURE 5).

As one would naturally expect, the species has several allies among the numerous species of *Plagiochila* found in the West Indies. Apparently the closest of these is *P. diffusa* Steph.,* a Cuban plant collected by Wright and distributed in his *Hepaticae Cubenses*. This species, however, is smaller and more delicate than *P. Smallii*, its leaves are shorter and relatively broader, the margins being more curved, the trigones of the leaf-cells are commonly indistinct, and the spine-like teeth at the mouth of the perianth are shorter. The insertion of the leaves in *P. diffusa* is very much the same as in *P. Smallii*; the line of insertion is sharply arched as in the majority of the *Plagiochilae*, and the leaves are consequently shortly but distinctly decurrent on both sides: Stephani's description would hardly indicate that this was the case.

Among other related species the following may be especially mentioned: *P. Wrightii* Steph.,† *P. tamariscina* Steph.‡ and *P. tenuis* Lindenb.§ The first of these is known from Cuba only; the second has been found in several of the West Indian islands; the third is still more widely distributed, its range extending into South America. In *P. Wrightii* the leaves are relatively broader than in *P. Smallii* and are rounded rather than truncate at the apex, a difference to be seen especially well in the perichaetial bracts. The inflorescence is almost always subtended by an innovation, and the bracts are crowded and in several pairs. *P.*

* Bull. Herb. Boissier II. **2**: 870. 1902.

† *L. c.* 681.

‡ *L. c.* 685.

§ Sp. Hepat. Plagioch. 50. *pl. 10.* 1841.

tamariscina is smaller and more irregularly branched than the Florida species, but agrees with it in being without a subfloral innovation. The leaves of *P. tamariscina* are relatively broader and their marginal teeth, although smaller, are usually more numerous. The leaf-cells are variable; in typical cases the walls are uniformly thickened through the coalescence of trigones, but in some cases the trigones are distinct, and in still others the walls are thin throughout. In *P. tenuis* the ♀ inflorescence bears a subfloral innovation which is itself often floriferous; the leaves have fewer teeth than in *P. Smallii*, and the leaf-cells have larger and more frequently confluent trigones, which are especially conspicuous in the perianth and bracts.

2. LOPHOCOLEA MARTIANA Nees, in G. L. & N. Syn. Hep. 152. 1845.

Jungermannia connata Nees, in Martius, Fl. Bras. 1[1]: 332. 1833; Ic. Plant. Crypt. 32. *pl. 17, f. 2.* 1828–1834. Not *Jungermannia connata* Swartz, Prodr. Fl. Ind. Occid. 143. 1788 (= *Lophocolea connata* Swartz & Nees, in G. L. & N. Syn. Hep. 153. 1845).

Blanton (*L. M. Underwood 228*). Everglades west of Miami (*Small & Nash 480*). In the hammocks near the homestead trail, between Cutler and Camp Longview (*Small & Carter 1355 p. p., 1371 p. p., 1396*). Widely distributed in the American tropics.

Lophocolea Martiana is fully described by Nees von Esenbeck in the *Synopsis Hepaticarum*, and also, more recently, by Spruce.* Both descriptions are drawn from robust and typical specimens and give an excellent idea of the plant as it usually appears. In some respects, however, the species is more variable than these descriptions would indicate. The leaves, for example, are approximately rather than truly opposite. At their antical bases they never quite correspond and are consequently never connate; at their postical bases they are either connate with the corresponding quadrifid underleaf or are connected with it by means of short and narrow wings; in this region the leaves are in some cases exactly opposite; but in other cases one of the two leaves will be much farther away from the underleaf than the

* Hep. Amaz. et And. 430. 1885.

other, making them appear distinctly alternate, and under these circumstances the wing may become exceedingly narrow or even obsolete. On a typical leaf the apex is broadly and more or less obliquely truncate and bears at each angle a sharp and slender tooth, the teeth usually diverging from each other. On a poorly developed leaf the teeth are often much less divergent or even subparallel and include between them a lunulate to acute sinus; on such a leaf the teeth are larger than on a typical leaf, and the postical tooth is appreciably larger than the antical.

The true *Lophocolea connata*, with which *L. Martiana* was originally confused, is also widely distributed in the American tropics and may perhaps be expected in southern Florida. It is distinguished by its bifid underleaves and by its less spinose bracts and bracteoles. Both species are autoicous.

3. DIPLASIOLEJEUNEA UNIDENTATA (Lehm. & Lindenb.) Schiffn. Bot. Jahrb. **23**: 583. 1897.

Jungermannia unidentata Lehm. & Lindenb. in Lehmann, Pug. Plant. **6**: 48. 1834.

Lejeunea unidentata Mont. in Ramon de la Sagra, Hist. Fis. Pol. y Natur. Cuba **9**: 478. *pl. 19. f. 2.* 1845.

Lejeunea (*Diplasio-Lejeunea*) *unidentata* Steph. Hedwigia **29**: 90. 1890.

In hammocks near the homestead trail, near Camp Longview (*Small & Wilson*, mixed with *2058*). Widely distributed in the West Indies.

The genus *Diplasiolejeunea* has not before been reported from the United States. It is distinguished from all the other genera of the *Lejeuneae* (except *Colurolejeunea*) by the possession of double the usual number of underleaves; in other words, this genus develops one underleaf for every leaf instead of for every pair of leaves. The underleaves are inserted on the axis at approximately the same level as the corresponding leaves. Aside from the duplication of the underleaves the genus is closely related to *Cololejeunea*, the lobules being built up on essentially the same plan.

In *D. unidentata* the leaves are destitute of hyaline margins and the lobe is orbicular or broadly ovate in outline. The leaf-cells are either plane or slightly convex. The lobule is inflated

except along the free margin, which is more or less appressed to the lobe. Two marginal teeth in the outer half of the lobule may usually be discerned. The inner tooth when normally developed points outward and consists of a row of two or three cells. The outer tooth, situated midway between the inner tooth and the end of the keel, is much larger and is apparently accountable for the specific name. This tooth points forward and is normally subulate in shape, averaging perhaps eight cells long and two cells wide in the lower half; it is, however, subject to a good deal of variation in size and shape and sometimes bears a short secondary tooth near the base. The underleaves are bifid to beyond the middle, and their straight divisions spread widely and are obtuse or subacute at the apex. *D. unidentata* is usually found on the bark of trees. According to Spruce* it is scarcely distinct from *D. pellucida* (Meissn.) Schiffn., which also has a wide distribution in tropical America. This latter species, however, is epiphyllous in habit and the lobes of its leaves are usually hyaline-margined.

4. **Cololejeunea diaphana** sp. nov.

Bright- or pale-green, scattered or very loosely cespitose, often mixed with other *Lejeuneae:* stems prostrate and closely adherent to the substratum, 0.035 mm. in diameter, sparingly and irregularly branched, the branches widely spreading: leaves distant, obliquely to widely spreading, the lobe ovate to lanceolate, 0.25 mm. long, 0.15 mm. wide, attached by a very short and almost transverse line of insertion, scarcely falcate, postical margin straight or somewhat curved, forming a continuous line with the keel, antical margin more strongly curved, apex acute to subobtuse, usually tipped with a single cell, margin varying from entire to slightly crenulate or denticulate from projecting cells; lobule (when well-developed) inflated, ovoid to obovoid, 0.1 mm. long, 0.07 mm. wide, keel slightly arched, free margin curved, involute toward the base, tipped at the apex with a rounded cell and bearing a short blunt tooth midway between the apex and the end of the keel; stylus reduced to a single papilla; leaf-cells plane or nearly so, averaging 13 μ at the margin, 18 × 13 μ in the middle and 30 × 16 μ at the base, thin-walled throughout or with very minute trigones: inflorescence autoicous: ♀ inflorescence sometimes on a short branch, sometimes on a leading branch, innovating on one side, the innovation sterile or again floriferous; bracts erect-spread-

* Hep. Amaz. et And. 302. 1884.

ing, more widely spreading after fertilization, complicate, the lobe narrowly oblong to lanceolate, 0.28 mm. long, 0.08 mm. wide, rounded to acute at the apex, margin as in the leaves, lobule oblong to cuneate, 0.12 mm. long, 0.035 mm. wide, apex mostly broad and obtuse, margin entire, or irregularly denticulate in apical region; perianth (immature) broadly obovate, 0.18 mm. long, 0.16 mm. wide, somewhat flattened, antical face plane, postical face with a broad and rounded keel, apex broad and truncate with a short beak, lateral keels sharp, denticulate from projecting cells, surface of perianth otherwise smooth or indistinctly roughened along the postical keel: ♂ inflorescence occupying a short branch or terminal on a longer branch; bracts distant to subimbricated, in one to six pairs, the lobe suberect, lanceolate, acute, 0.13 mm. long, 0.06 mm. wide, margin as in the leaves, lobule slightly concave, obovate, bluntly pointed, 0.08 mm. long, 0.05 mm. wide, entire or indistinctly denticulate; antheridia solitary: mature sporophyte not seen. (PLATE 5, FIGURES 9–14.)

In hammocks near the homestead trail, between Cutler and Camp Longview (*Small & Carter 1365 p. p., 1370 p. p.*). *No. 1365* may be designated the type.

C. diaphana is smaller and much more delicate than any of the other species of *Cololejeunea* known from the United States. The only one which it at all resembles is *C. Biddlecomiae* (Aust.) Evans, * in which also the leaves are more or less narrowed toward the apex and often acute. But in *C. Biddlecomiae* the whole outer surface of the lobe is roughened from projecting cells, there is a long stylus at the base of the lobule, and the roughened perianth is sharply five-keeled.

Among the tropical species, *Lejeunea* (*Colo-Lejeunea*) *ensifolia* Spruce, † an epiphyllous plant found in the Amazon region, is closely related to *C. diaphana*, but differs in its longer and more sharply pointed leaves, which are furthermore falcate and hamate. The variety *pigmaea* of this species, which, as Spruce implies, may be worthy of specific rank, has broader leaves than the type but is distinguished from *C. diaphana* by its five-keeled perianth, the keels projecting upward as short and rounded horns.

5. **Lejeunea floridana** sp. nov.

Bright- or pale-green, growing in depressed tufts, often mixed with other hepatics: stems prostrate, 0.14 mm. in diameter,

* Mem. Torrey Club 7: 168. 1902.

† Hep. Amaz. et And. 297. 1884.

irregularly branched, the branches obliquely to widely spreading, not microphyllous but usually with somewhat smaller leaves than the stem; rhizoids numerous, springing from the underleaves: leaves contiguous to loosely imbricated, the lobe widely spreading, ovate, 0.7 mm. long, 0.5 mm. wide, attached by a long and almost longitudinal line of insertion, antical margin straight or slightly curved near base, then more strongly curved to apex, postical margin less strongly curved, apex mostly broad and rounded, very rarely obtusely pointed, margin subentire or slightly and irregularly crenulate from projecting cells; lobule often obsolete, when well-developed inflated, triangular-ovoid, 0.12 mm. long, 0.09 mm. wide, keel slightly arched, roughened from projecting cells, free margin involute to apex, then passing by a long and shallow sinus to end of keel, apex tipped with a single, very blunt cell bearing a hyaline papilla at its proximal base; cells of lobe plane or somewhat convex, averaging 20 μ at the margin and 33 × 25 μ in the middle and at the base, thin-walled throughout or with very minute trigones: underleaves distant, plane, orbicular, 0.2 mm. long, somewhat narrowed toward the base, bifid about one third with broad, triangular, rounded or obtuse lobes and a narrow sinus; margin very slightly crenulate from projecting cells; radicelliferous region bounded on each side by a large cell, sometimes developing a rudimentary disc: inflorescence autoicous: ♀ inflorescence borne on a leading branch or on a short branch, innovating on one side, the innovation sterile or again floriferous; bracts obliquely spreading, slightly complicate, the lobe oblong to ovate, 0.8 mm. long, 0.35 mm. wide, rounded to subacute at the apex, margin as in the leaves, lobule narrowly oblong, 0.25 mm. long, 0.04 mm. wide, scarcely projecting beyond end of keel, blunt, entire; bracteole slightly connate on both sides with bracts, ovate to obovate, 0.45 mm. long, 0.35 mm. wide, bifid about one tenth with broad, rounded or obtuse divisions and an obtuse sinus, margin as in the leaves; perianth slightly or not at all exserted beyond the bracts, obovoid, 0.7 mm. long, 0.4 mm. in diameter, narrowed toward the base, broad at the apex and with a distinct ciliolate beak, terete below, sharply five-keeled in upper third, the keels crenulate from projecting cells and extending upward as short rounded processes, surface otherwise smooth or nearly so: ♂ inflorescence occupying a short branch; bracts in two to ten pairs, imbricated and strongly inflated, 0.17 mm. long, 0.1 mm. wide, shortly bifid with obtuse divisions, the lobule slightly smaller than the lobe; antheridia solitary or in pairs; bracteoles at base of spike only, rotund and shortly bifid: mature sporophyte not seen. (PLATE 5, FIGURES 15-21.)

In hammocks near the homestead trail, between Cutler and

Camp Longview (*Small & Carter 1355 p. p., 1365 p. p.*). *No. 1355* may be designated the type. It is possible that the sterile specimens collected by Underwood at Ocala, Florida, in January, 1891, and distributed in *Hep. Amer. 178* (as *Lejeunea serpyllifolia*) should be referred to this species, but they are in too poorly developed a condition for positive determination.

One of the closest allies of *L. floridana* is *L. quinqueumbonata* Spruce,* which is known from the region of the Amazon. In both species the perianths are five-keeled in the upper part only and crenulate along the keels. Spruce refers his species to the subgenus *Otigonio-Lejeunea* but states that it approaches certain species of *Eu-Lejeunea* and that it would not be unnatural to include it among them. It agrees with typical species of *Otigoniolejeunea* in its general habit, in its rather large perichaetial bracts, and in the short keels of its perianth; it differs from them, however, because the keels do not project as long horns but merely as rounded processes, and also because the perianth is distinctly beaked. In the writer's opinion these differences are sufficient to remove the species from *Otigoniolejeunea* and to place it in *Lejeunea*. In *L. floridana* the lobules are even smaller than in *L. quinqueumbonata*, the lobes of the leaves are never pointed, and the margins of the leaves and bracts are either entire or much less strongly crenulate.

There are only two other species of *Lejeunea* known from Florida; one of these is the widely distributed *L. americana* (Lindb.) Evans; the other is noted below. *L. floridana* differs from *L. americana* in its laxer habit, in its smaller lobules and underleaves, and in the short and crenulate keels of its perianth.†

In the texture of its leaves *L. floridana* bears some resemblance to poorly developed specimens of *Cheilolejeunea phyllobola* (Nees & Mont.) Schiffn.,‡ with which it also agrees in its small lobules and underleaves and in its autoicous inflorescence. The *Cheilolejeunea* is a more compact species and its prostrate stems are more closely appressed to the substratum; it also exhibits a tendency to develop flagelliform branches with caducous leaves. Its deeply bifid underleaves, however, with sharply pointed divi-

* Hep. Amaz. et And. 230. 1884.

† Mem. Torrey Club 7: 154. *pl. 20, f. 14–26.* 1902.

‡ See Evans, Mem. Torrey Club 7: 143. 1902.

sions offer the best differential characters, and these are supported in fruiting specimens by the broader perianth with plane antical surface and smooth keels.

6. LEJEUNEA GLAUCESCENS Gottsche; G. L. & N. Syn. Hep. 378. 1845.

Lejeunea (*Eu-Lejeunea*) *glaucescens* Steph. Hedwigia **29**: 85. 1890.

Breckell's Hammock (*E. G. Britton 32*). Widely distributed in the American tropics.

The leaves and underleaves of *L. glaucescens* are so much like those of *L. floridana* that it would be difficult to distinguish the species in sterile condition. Even the leaf-cells in the two species are very similar, although the cell-walls in *L. floridana* are perhaps a little more delicate. In both species, moreover, the inflorescence is autoicous and the female flower is subtended by a single innovation. In the involucre and perianth, however, the differential characters become apparent. In *L. glaucescens* the bracts are shorter than the leaves and the lobules are usually distinctly pointed; the bracteole is sharply bifid about one third with acute or subacute divisions; the perianth is five-keeled to below the middle, and the keels, although minutely crenulate, do not project upward as horns; as the sporophyte matures the keels tend to become obliterated. The male spikes of *L. glaucescens* differ from those of *L. floridana* in being shorter and broader.

7. **Cheilolejeunea decidua** (Spruce).

Lejeunea (*Cheilo-Lejeunea*) *decidua* Spruce, Hep. Amaz. et And. 257. 1884.

In hammocks near the homestead trail, between Camp Longview and Cutler (*Small & Carter 1370 p. p., 1408*). Breckell's Hammock (*Howe 81*). Everglades near Camp Longview (*Small & Wilson 1550*). Long Key, mainland (*Small & Wilson 1551*). The original material of *C. decidua* was collected by Spruce in the region of the Amazon, and so far the species has been reported from no other localities. The Florida specimens are either sterile or male, but they agree so perfectly with those distributed in the *Hepaticae Spruceanae* that they can hardly represent any other species.

The specific name *decidua* refers to the fact that the leaves on some of the branches exhibit a strong tendency to break off. They are set free by a tearing across of the lobe near the lobule, sometimes leaving a complete water-sac behind, sometimes tearing away a portion of its wall; in any case the lobule is left intact. In general appearance the species bears much resemblance to two other *Lejeuneae* which have also been found in Florida; namely, *C. phyllobola* and *C. versifolia* (Gottsche) Schiffn.* Both of these species are pale in color and both develop flagelliform branches from which the leaves fall away, leaving nothing except the underleaves behind. *C. decidua* differs from *C. phyllobola* in the long and pointed apical teeth of its lobules, in its dioicous inflorescence, and in its usual lack of a subfloral innovation. It differs from *C. versifolia* in its much larger leaf-cells, none of which develop into ocelli, and in its cell-walls, which show distinct trigones instead of being uniformly thickened.

8. CERATOLEJEUNEA CUBENSIS (Mont.) Schiffn. in Engler & Prantl, Nat. Pflanzenfam. 1^3: 125. 1893.

Lejeunea cubensis Mont. in Ramon de la Sagra, Hist. Fis. Pol. y Natur. Cuba **9**: 481. *pl. 18, f. 2.* 1845.

Colura cubensis Trevis. Mem. R. Ist. Lomb. III. **4**: 402. 1877.

Lejeunea (*Cerato-Lejeunea*) *cubensis* Spruce, Hep. Amaz. et And. 202. 1884.

In hammocks near the homestead trail, between Cutler and Camp Longview (*Small & Carter 1355 p. p., 1431; Small & Wilson 1527*), and in the vicinity of Silver Palm School (*Small 2349*). Widely distributed in tropical America.

Although *C. cubensis* has bifid underleaves and consequently belongs to the *Lejeuneae Schizostipae*, it cannot be confused with any of the other members of this group known from the United States. The most striking of the differential characters which it presents are the following: the deep olive-green or olive-brown color due to the pigmentation of the cell-walls, the more or less pointed lobes irregularly toothed in the apical region, the thick-walled leaf-cells with distinct middle lamella, and the four-horned perianth. Most of these characters are of course generic in value.

* See Evans, Mem. Torrey Club **7**: 145. 1902.

The genus *Ceratolejeunea* has many other representatives in the West Indies, and it is possible that one or more of these will be found in Florida. *C. cubensis*, however, may be readily distinguished by the following combination of characters: the lobes are ocellate at the base, the lobules are inflated but small and never develop into large utriculi at the base of a branch, the underleaves are small and orbicular, bifid about one half with acute divisions and never cordate at the base, the inflorescence is autoicous, the bracts and bracteoles are usually coarsely serrate, and the horns of the perianth are short and obliquely spreading to suberect.

9. LOPHOLEJEUNEA SAGRAEANA (Mont.) Schiffn. in Engler & Prantl, Nat. Pflanzenfam. 1^3: 129. 1893.

Phragmicoma Sagraeana Mont. in Ramon de la Sagra, Hist. Fis. Pol. y Natur. Cuba **9**: 464. *pl. 18, f. 1.* 1845.

Lejeunea Sagraeana Mont.; G. L. & N. Syn. Hep. 314. 1845.

Phragmicoma cyclostipa Tayl. *p. p.* Lond. Jour. Bot. **5**: 387. 1846.

Lejeunea cyclostipa Tayl. *p. p.*; G. L. & N. Syn. Hep. 749. 1847.

Symbiezidium cyclostipum Trevis. *p. p.* Mem. R. Ist. Lomb. III. **4**: 493. 1877.

Symbiezidium Sagraeanum Trevis. *l. c.*

Lejeunea (*Lopho-Lejeunea*) *Sagraeana* Spruce, Hep. Amaz. et And. 129. 1884.

In hammocks near the homestead trail, between Cutler and Camp Longview (*Small & Carter 1370 p. p.*). Snapper Hammock (*E. G. Britton 479*). Breckell's Hammock (*E. G. Britton 84; Howe 88*). Miami (*Small & Wilson 1529*). Long Key, mainland (*Small & Wilson 1503 p. p., 1521, 1533 p. p.*). Elliott's Key (*Small 2348 p. p.*). A tropical species, widely distributed in America and in Africa. Stephani * reduces to *L. Sagraeana*, as a synonym, *Lejeunea subfusca* Nees, a species originally collected in Java but now known to have a much wider distribution. *L. subfusca* is based on *Jungermannia subfusca* Nees, Hep. Jav. 36. 1830. It was therefore published before *L. Sagraeana*, and, if the two species are really synonymous, Nees von Esbenbeck's specific name should not be superseded. According to Schiffner,† however, it

* Hedwigia **29**: 16. 1890.

† Consp. Hep. Arch. Ind. 295. 1898.

may be possible to keep the two species distinct, and for this reason the well-known specific name of Montagne is here retained.

The genus *Lopholejeunea* is distinguished from the other genera of the *Lejeuneae Holostipae* by the absence of subfloral innovations and by the possession of a four-keeled perianth, the keels being bordered by toothed or laciniate wings. The antical surface of the perianth is smooth, two of the keels are lateral and the others are postical. Most of the species are dark brownish green in color, varying to a paler green on young branches. These peculiarities, although generic in value, will also serve to separate *L. Sagraeana* from the other *Lejeuneae* occurring in Florida.

YALE UNIVERSITY.

Explanation of plate 5

FIGURES 1–8. *Plagiochila Smallii* Evans

FIG. 1. Part of stem, antical view, × 9.
FIG. 2. Part of stem, postical view, × 9.
FIG. 3. Leaf spread out flat, × 16.
FIG. 4. Cells from middle of leaf, × 200.
FIG. 5. Cells from postical margin of leaf, × 200.
FIG. 6. Apex of a large tooth, × 200.
FIG. 7. Perichaetial bract, × 16.
FIG. 8. Perianth, × 24.
The figures were all drawn from the type-specimens.

FIGURES 9–14. *Cololejeunea diaphana* Evans

FIG. 9. Part of plant showing perianth and large ♂ inflorescence, postical view, × 55.
FIG. 10. A branch with ♀ inflorescence, postical view, × 55.
FIG. 11. Part of plant showing small ♂ inflorescenee, postical view, × 55.
FIG. 12. Part of stem showing one leaf with a well-developed lobule, postical view, × 55.
FIG. 13. Cells from apex of lobe, × 265.
FIG. 14. Apex of lobule, × 265.
The figures were all drawn from the type-specimens.

FIGURES 15–21. *Lejeunea floridana* Evans

FIG. 15. Part of stem with perianth, postical view, × 35.
FIG. 16. Branch with two ♀ inflorescences, postical view, × 35.
FIG. 17. ♂ inflorescence, × 35.
FIG. 18. Cells from antical margin of lobe, × 200.
FIG. 19. Apex of lobule, × 200.
FIG. 20. Underleaf, × 200.
FIG. 21. Perichaetial bracts and bracteole, × 35.
Figure 21 was drawn from *1365 p. p.*, the remaining figures from the type-specimens.

New species of western plants

ALICE EASTWOOD

Clematis biflora sp. nov.

Lower leaves pinnately compound, with 5 ternate or quinate leaflets; petioles and rachis tomentose especially at the axils, horizontally spreading; leaflets ovate-acuminate, the terminal about twice as long as the lateral, 4 cm., dentately lobed, the teeth or lobes mucronate, base obtuse, surface somewhat pubescent but not tomentose, veiny, bright-green; leaves of the flowering stems simpler, much smaller, the leaflets cuneate at base: peduncles axillary, 2-flowered (sometimes 1-flowered from the abortion of the other bud); bracts minute, simple or trifoliate: flowers perfect, with sepals elliptical to oblanceolate, rather thin, 15 mm. long, about half as wide, obtuse or mucronate, tomentose: stamens shorter than the sepals, with flat filaments in 2 or 3 sets; anthers narrowly oblong, 1.5 mm. long, as broad as the filaments: carpels bristly-ciliate with discontinuous cilia, hispid at the top and with densely plumose tails an inch or more in length.

This species was collected by Mr. T. S. Brandegee on the Island of Santa Cruz, off the coast of Santa Barbara, California, April, 1888, and listed as *C. pauciflora* Nutt., in the list of the plants of the island published in Zoe (**1**: 131). From this species it differs in the acuminate, more numerous, and larger leaflets; flowers equal in size to those of *C. lasiantha* Nutt.; sparingly hispid akenes and densely plumose tails. It is also allied to *C. lasiantha*, but differs in the absence of tomentose pubescence, the more numerous leaflets, the thinner and less tomentose sepals and the more glabrous carpels, and most especially in the two-flowered peduncles.

Aquilegia Shockleyi sp. nov.

Stems branching, glabrous on the lower part, viscid-pubescent on the upper, clothed at base with the bleached persistent remains of the leaves, about 4 dm. high: radical leaves varying in length

from much shorter than the stem, scarcely reaching the lowest branches, to 5 dm. high with long, stout petioles almost twice as long as the triternate blades; leaflets pale-green, glabrous but under the lens densely covered with shining yellow glands, deeply 3-cleft, cuneate in outline, 3-lobed with cuneate, deeply crenate lobes, the middle leaflet broad, petioluled, the lateral generally unequal-sided, often sessile; cauline leaves with short sheathing petioles, less compound than the radical leaves, upper ones 3-cleft with narrowly linear, acute divisions: bracts simple, linear-acuminate: sepals lanceolate, obtuse, somewhat undulate especially towards the short curved claw; blade 17 mm. long, 6 mm. broad; claw somewhat more than 2 mm. long, rather stout, slightly margined: petals, including the long straight red spur, 3.5 cm. long, attenuate above the globular honey-gland 6 mm., then gradually dilating to the throat; claw yellow, 5–6 mm. long, 4 mm. wide, truncate or rounded at apex, the point of insertion deeply emarginate: stamens with ribbon-like filaments broadening towards the base, anthers oblong-elliptical, acute, 1.5 mm. long; staminodia abruptly acuminate; ovaries almost as long as the styles, together 15 mm., glandular-pubescent with spreading hairs: follicles veiny, pubescent, spreading but little, the seeds extending to the apex: seeds reddish brown, oblong-elliptical.

This was collected by W. H. Shockley at Soda Spring Cañon, Esmeralda County, western Nevada, July, 1888, being *no. 504* of his collection and distributed as *A. truncata* F. & M. It is really nearer *A. formosa* Fisch., but is distinct from that and allied species by the color and pubescence of the foliage, the long, slender spur and prominent lamina of the petal.

Myosurus nitidus sp. nov.

Stems 1.5–2 cm. high in fruit: leaves half the height of the plant, glossy, linear: fruiting spike cylindrical, 3–18 mm. high, peduncles 3–10 mm., the longest spike having the shortest peduncle: mature carpels roundish, shining as if polished, flat but with margins thickened, keeled by the appressed or spreading subulate beak.

The specimens collected were in fruit, so the description of petals, sepals and stamens cannot be given. It is near *M. cupulatus* Watson, but differs in the more glossy body of the akene, which is not at all cupulate. Collected by the author at Mancos, Colorado, growing under sage-brush, June, 1891.

Horkelia glandulosa sp. nov.

Stems several from the woody rootstock, 6 dm. high, stout and rather coarse, finely viscid-glandular throughout and softly villous with silky hairs, some of the radical leaves 4 dm. long, with 11 leaflets; petioles stout, furrowed on the inner side, broadly sheathing at base; leaflets oblong to orbicular in outline, cuneate at base, laciniately lobed, the lobes laciniately dentate, the uppermost leaflet largest, some 4 cm. long and wide; petiolules short; cauline leaves smaller, with stipules like the leaflets but somewhat smaller: flowers in terminal cymes, a few smaller clusters also often in the upper axils, the central flower on a pedicel longer than the calyx, the others subsessile: calyx almost concealed by the bractlets, urceolate, rounded at base, the tube 5 mm. long, the divisions 3 mm. wide at base, 5 mm. long, tapering to a slender point, glandular and hairy on the outside, glabrous on the inner; appendages declined, the same shape and length as the calyx-segments but narrower, glandular and hairy on both sides: petals white, oblong, without claws, 6 mm. long, 4 mm. wide: filaments broad, as long as the anthers, inserted in two sets, one below the other on the calyx-tube: styles 5 mm. long, brownish at base, inserted near the tops of the subreniform ovaries: akenes brown, polished, shaped somewhat like an oyster-shell, obliquely concave on one side.

Type collected by the author at Laytonville, Mendocino County, California, August 2, 1903. This is the largest species of the genus so far described; the whole plant has a pleasant fragrance and it seems most closely related to *H. californica* C. & S.

Astragalus Titi sp. nov.

Annual, branching from the base and above, slender, 1–1.5 dm. high, slightly pubescent: leaves 3–6 cm. long, with 5–9 rather distant leaflets, the petioles about half the entire length, slender, stipules falcate-attenuate, membranous with green midvein, those on the lower leaves sparingly clothed with white hairs, those on the upper leaves with black hairs; leaflets narrowly oblong to cuneate, truncate or emarginate at apex, the base narrowing to a short yellow petiolule, upper surface glabrous, lower clothed with scattered hairs appressed diversely, 4–8 mm. long, 2–4 mm. wide: capitate clusters containing about 6 flowers from almost the lowest axils, on slender peduncles 2–3 cm. long, the pedicels 1 mm. long, black-hairy: calyx with similar pubescence, the campanulate tube tinged with purple, 1.5 mm. long, obtuse at base with linear-subulate divisions 2 mm. long: corolla violet, the banner and wings lighter in color than the keel, the banner with orbicular blade 4

mm. in diameter, shallowly emarginate and slightly erose along the apex, the claw 2 mm. long, wedge-shaped, 1.5 mm. wide at top, the base abruptly acute; wings surpassing the keel 2 mm., almost 2 mm. wide at top, the slender claw 2 mm. long with a horizontal, toothlike appendage at top; keel 3 mm. long, rounded at top: alternate filaments shorter, anthers orbicular: style 2 mm. long, thickest at base, tipped by a yellow globular stigma: pods erect, completely 2-celled by the intrusion of the dorsal suture, abruptly pointed and tipped with the curved style, becoming 7 mm. long, appressed white-pubescent, 6-seeded, the cross-section 3 mm. wide, broadly cordate.

Collected by Dr. F. H. Titus, in whose honor it is named, on the Seventeen Mile Drive at Monterey, California, about four miles from Pacific Grove, near an old hut composed of Abalone shells and coal-oil cans. The type specimens were collected by Mrs. Joseph Clemens, May 8, 1904. It is related to *A. Breweri* Gray, differing most noticeably in the fruit. While *A. Breweri* has an ovate pod, attenuate to the long style, this pod is narrowly oblong, as broad near the top as the bottom, and the style is much shorter. Its flowers are smaller and the calyx less densely black-villous.

Vicia Durbrowi sp. nov.

Climbing a meter or more, slender, angled, villous throughout with fine, silky, spreading hairs: leaves almost sessile, with branched tendrils; leaflets 8–11, alternate, thin, conspicuously veiny, equally villous on both surfaces and but little paler on the lower, oblong, 1.5–2.5 cm. long, 1–1.5 cm. wide, sharply dentate from the apex to about the middle, sometimes almost entire, truncate and shortly aristate, obtuse and subsessile at base; stipules sessile, broad, pedately lobed with triangular teeth: racemes shorter than the leaves, on slender curving peduncles which are generally as long as the flowering part: flowers 3–6, pedicels shorter than the calyx: upper lip of calyx purplish with 2 sharply pointed teeth 1 mm. long, separated by a broad rounded sinus; lower with 3 long, acuminate teeth almost 4 times as long as the upper, finely villous, tube rounded at base: corolla violet, the banner with blade slightly broader than claw, 16 mm. long, about half as wide, truncate and shortly mucronate at apex, strongly reflexed; wings with blade slightly longer than claw, broadening towards the rounding top, sharply auriculate at base; keel short, its purple-tipped apex obtuse, 5 mm. long, the claw 7 mm.: style glabrous; stigma tufted at tip with white hairs; ovary pubescent, 7–10-ovuled, on a stipe 4 mm. long: pod villous-pubescent, flat.

Collected by the author at Wawona, Mariposa County, California, along the little stream back of the hotel, July 5, 1902. It is named in honor of my friends Mr. and Mrs. Pierson Durbrow, who were my companions on the trip to the Yosemite when it was collected.

Vicia Copelandi sp. nov.

Climbing rather high and branching, glabrous, angles ribbed leaves almost sessile, with capillary branching and pubescent tendrils; stipules small with several sharply acuminate digitate lobes; leaflets 6–10, petiolulate, elliptical and oblong, to ovate-lanceolate, thin, membranous, glabrous, veiny, paler on the lower surface, obtuse at apex or truncate and mucronate, margin entire or undulate, 1.5–3 cm. long, 1–1.5 cm. wide: flowers few, in racemes shorter than the leaves; peduncles slender, 4 cm. long, pedicels 1–2 mm.: calyx slightly pubescent, its teeth shorter than the tube, membranously white-margined, the 2 upper very short with broad sinus between, the 3 lower subulate, 3 mm. long: corolla almost 2 cm. long, violet; standard orbicular, obcordate, 11 mm. in diameter, the claw broad, almost 1 cm. long, 6 mm. broad, slightly saccate at base; wings surpassing the keel by 6 mm.; keel broad, truncate, with a darker spot at tip: ovary tapering at both ends, at base ending in a stipe as long as the abruptly bent style, puberulent; stigma conspicuously tufted.

This interesting species was collected on the headwaters of the Sacramento River near Sissons at the foot of Mt. Shasta, California, August 12, 1903, by Dr. Edwin Bingham Copeland, in whose honor it is named. Superficially it resembles a species of *Lathyrus;* but is at once distinguished by the stigma.

Lathyrus Goldsteinae sp. nov.

Slender, climbing; stems angled, lower part glabrous, upper clothed with soft spreading pubescence: leaves terminating in long, branching tendrils; leaflets 6–10, opposite or alternate; petioles 1 cm. long on the lower leaves, wanting on the upper; stipules narrowly semi-sagittate, entire, veiny, narrowly attenuate, soft-pubescent, the upper part 1 cm. long, 3 mm. wide, lower 5 mm. long, half as wide; leaflets on short petiolules (about 1 mm.), linear-oblong, tipped with a slender mucro, narrowed at base, 3–4 cm. long, about 5 mm. wide, softly pubescent, paler on the lower than the upper surface: flowers in racemes much shorter than the leaves, 4–6-flowered, the peduncles as long as the racemes; pedicels shorter than the calyx: upper lip of calyx shorter than the

lower, 2-cleft with a gusset-like sinus; lower lip with 3 triangular acuminate teeth, 2.5 mm. long; all divisions membranously margined; calyx 6 mm. long, silky-pubescent: corolla violet and white, the banner orbicular, undulate, 1 cm. wide with a broad claw 7 mm.; wings surpassing the keel, oblong; keel strongly geniculate, pointed; ovary glabrous, style sparingly hairy half way from the tip: legume not seen.

Collected at Lakeside Park, near Lake Tahoe, California, July 1, 1903, by Miss Lutie Goldstein, in whose honor it is named. This species, which might easily be mistaken for a *Vicia*, is distinct from related species in its small flowers, racemes much shorter than the leaves, conspicuous tendrils, and narrow entire stipules.

Thermopsis venosa sp. nov.

Stems branching, 4–5 dm. high, glabrous, striate: leaflets obovate-rhomboid to oblong, conspicuously reticulate, glabrous, 5–9 cm. long, 4 cm. wide, cuneate at base; petioles 2–5 cm. long; lowest stipules suborbicular to broadly ovate, 5 cm. long, 3–4 cm. wide; uppermost lanceolate, 2–2.5 cm. long: racemes on long peduncles, 9–12 cm., sometimes with a single bract about the middle; pedicels equaling or surpassing the calyx, erect; bracts lanceolate, equaling or shorter than the pedicels; calyx thin, slightly pubescent, the broad upper part with a shallow triangular notch, lower with 3 triangular teeth: corolla with banner 1.5 cm. long, 12 mm. wide, deeply obcordate, wings shorter, keel truncate at apex, 16 mm. long: legume spreading horizontally, glabrous, flat, generally straight, 5–7 cm. long, 5–7 mm. broad, with a short, stout stipe and acute or pointed apex, the seeds distinctly outlined through the pod.

Collected by the author on the Lewiston Trail near the summit which divides Trinity from Shasta County, California, July 3, 1901. It is distinguished by the large glabrous leaves, broad stipules, flat glabrous legumes and calyx different from any other species. It is most closely allied to *T. gracilis* Howell, but differs in the absence of pubescence and in the shape and size of all the organs.

Rosa rivalis sp. nov.

Shrub, 1 m. or more high, glabrous, with very few spines or prickles, these slender, straight, short from a broad base, 2–3 together, 1–4 mm. long; older wood dark wine-colored; leaflets 5–7, the uppermost largest, oblong to elliptical and suborbicular, or

even obovate, 1–5.5 cm. long, 0.5–3.5 cm. wide, the rachis and veins on lower surface tomentose, otherwise glabrous, irregularly serrate; stipules extending half up the petiole, the lower part decurrent, the upper dilated, acuminate, entire or glandular-toothed, the rachis occasionally with a few small prickles: flowers solitary or in 3–4-flowered umbels, terminating clustered peduncles at the ends of the branchlets; bracts foliaceous, obovate, attenuate at apex, tapering to a broad petiole 1–2 cm. long; pedicels slender, glaucous, 1–2 cm. long: sepals ovate, tapering to a long slender, foliaceous tip, lanceolate, 5 mm. to more than 1 cm. long, the slender petiole-like part 5 mm., the lower part keeled, with a few gland-tipped hairs, and tomentose margins, the entire calyx 2 cm. long; corolla rose-colored: immature fruit globular, with a short neck, glaucous.

Collected by the author along a small stream, in the shade of the trees, near Laytonville, Mendocino County, California, August 3, 1902.

This seems unlike any other species in California. It is distinguished by the stems almost destitute of prickles, the extremely long foliaceous calyx-divisions, and the peculiar inflorescence.

Adenostoma fasciculatum densifolium var. nov.

This is marked from the typical form by the closely clustered fascicles of leaves on the flowering stems; the leaves are short-aristate, with few scattered hairs; the inflorescence is narrow, a densely-flowered spicate thyrsus, often with one or two short branches at base. The inflorescence resembles a slender finger in shape and size. This singular variety was collected on Mt. Wilson, near Pasadena, California, by Fordyce Grinnell, Jr., June 6, 1903.

Heuchera Merriami sp. nov.

Rootstock thick, coated with dry, sheathing petioles, horizontal; stems several from the caudex, 2 dm. high, generally with a small leaf near the base: radical leaves orbicular, truncate at base, slightly lobed, the lobes crenate and each crenature apiculate, ciliate, 2–3 cm. wide, and about as long, glandular and hispid especially on the lower surface; petioles 1–4 cm. long, clothed with glandular, spreading hairs, stipules white-membranous, very glandular, auriculate at apex, the entire base of the petiole 5 mm.: panicle glandular-puberulent and hairy, somewhat contracted: peduncles 5–10 mm. long, cymes closely 5–9-flowered; the pedi-

cels of all except the earliest shorter than the calyx; bracts 3-parted with linear-attenuate divisions, the upper simple; bractlets minute, linear-attenuate: calyx orbicular-campanulate, 3 mm. long in flower, 5 mm. in fruit, the divisions 1 mm. long, varying in width in the same flower from 1–2 mm.; tube rounded or slightly cuneate at base: petals white, oblanceolate, obtuse, narrowed to a bulb-tipped base: filaments rather broad, inserted lower on the calyx-tube than the petals and surpassing them; anthers yellow, orbicular: style and ovary puberulent, stigmas capitate and later becoming bulbous, exserted and strongly divaricate: seeds brown, oblong or elliptical, echinate, 0.5 mm. long.

Collected at the upper part of Canyon Creek, Trinity County, California, in fruit, August, 1899, by Dr. C. Hart Merriam, in whose honor it is a privilege to name it. The author collected it in flower and fruit at the same general locality, July 14, 1901, the latter specimens being taken for the type.

Lithophragma trifoliata sp. nov.

Stems from slender, running rootstocks, striate, scabrous-hispid, upper part clothed with gland-tipped hairs, generally 2-leaved and about 3 dm. high: radical leaves with long, lax, glandular-hispid petioles, dilated and sheathing at base, erosely ciliate; blade orbicular in outline, the 3 palmate divisions tapering to a slender base, each with 3 or 4 cuneate lobes with margin crenate the crenatures callous-apiculate, scabrous on both sides, lower leaves often simpler; cauline leaves on short petioles with broad, membranous, erosely ciliate stipules, the blades with sharper and narrower divisions than the radical leaves: flowers few, in short subcapitate racemes; bracts white-membranous, enclosing the base of the petioles, about 1 mm. long, twice as broad, sparingly ciliate, pedicels erect, shorter than the calyx, about 3 mm. long; calyx turbinate, attenuate at base, broadest at the insertion of the petals and stamens, the divisions conniving and narrowing the calyx at the top, triangular, apiculate, as long as the part of the tube above the ovary: petals 3-lobed to below the middle; blade 7 mm. long: the lateral divisions linear, acute, the terminal obovate, obtuse, claw slender, 3 mm. long: ovary half-included, the stigmas broad, sessile.

Collected by Mrs. R. M. Austin in Modoc County, also by her daughter, Mrs. C. C. Bruce, in the foothills near Chico, Butte County, California, April, 1897, *no. 1844* of her collection (type).

It is peculiar in the narrow turbinate calyx with connivent

lobes and the subcapitate raceme. It is nearest to *L. affinis* Gray, but has a much longer calyx, the tube more narrowed at base.

Jepsonia heterandra sp. nov.

Roots fleshy: stems slender, several from the thick fleshy caudex, flowering in the autumn, loosely racemose, or paniculate, glandular-puberulent: leaves appearing in spring, orbicular-reniform with many short, crenate lobes, the crenatures callous-apiculate; blade subglabrous; petioles glandular-hairy, 3–6 cm. long, rather broad, sheathing the branches of the caudex: pedicels filiform, 5–15 mm. long: calyx-tube with 10 red veins, truncate, cuneate at base, 4–5 mm. long, the triangular-acute lobes half as long: petals white, tinged or veined with rose, acute at apex, narrowed to a short claw at base: stamens of two forms in the same plant, some flowers with filaments only as long as the anthers, others with filaments 2.5 mm. long, anthers orbicular, rose-colored: styles in the short-stamened flowers about 5 mm. long, in the long-stamened less than 1 mm.; stigma bulbous: seeds immature.

Collected by Mr. J. W. Congdon on banks of Merced River, near Benton's Mills, Mariposa County, California, in October, 1883, with leaves April, 1884. The description of the root is taken from specimens collected by Major R. A. Scupham, October 24, 1889, six miles east of La Grange at the extreme west part of Tuolumne County, growing on a slate outcrop.

The species differs from *J. Parryi* Small in broader and more acute petals, longer calyx-teeth, and heterogonous flowers.

Arctostaphylos franciscana sp. nov.

Low spreading shrub, rooting along the stems: older stems dark red, the exfoliated bark persisting, younger stems somewhat white-tomentose: leaves narrowly obovate to oblanceolate, glossy-green and glabrous on both sides when old, slightly tomentose when young, the apex sharply acuminate and aristate, base pointed, scabrous-ciliolate along the margins, 2–3 cm. long, 5–12 mm. wide; petioles 2–4 mm. long: panicles short, terminating some of the branchlets; peduncles 5 mm. long, tomentose; bracts 2–5 mm. long, shorter than the glabrous, ribbed pedicels, the lower longest, ovate, attenuate; pedicels becoming deflexed and longer in fruit, 6 mm.: calyx-divisions orbicular, thin, membranous, glabrous, generally without cilia, 1 mm. in diameter: corolla broadly urceolate, 6 mm. long, 5 mm. broad, sparingly hairy in the throat and below, the short rounded divisions spreading, min-

utely papillate: stamens shorter than the style; filaments subulate-attenuate, 2 mm. long, with cilia sparingly margining the base; anthers dark wine-colored, 1 mm. long, the hairy horns slightly longer, deflexed: style somewhat club-shaped, scabrous-puberulent on the ribs and depressions, stigma 0.5 mm. broad, not exserted; ovary conical, as broad at base as the receptacle, a little more than 1 mm., scabrous-puberulent: berry glabrous, globular, 5–7 mm. in diameter. The bud-scales are red or yellowish.

This grows in Laurel Hill Cemetery in San Francisco, over a limited area on rocky ground. There are some plants on the road to Pt. Reyes lighthouse which appear to be the same, but which have not flowered for three years and have never been collected in either flower or fruit. This has been confounded with *A. pumila* Nutt. It differs in more prostrate habit, glabrous foliage, larger flowers and fruits. *A. pumila* appears to be local near Monterey.

Arctostaphylos auriculata sp. nov.

Shrub with erect branches, 1–1.5 m. high, old wood smooth, red-brown; young stems glaucous, clothed with fine, white, arachnoid tomentum and long, loosely spreading, fine, white hairs: leaves oblong to ovate, mucronate at the obtuse or acute apex, auriculate at base, the rounded auricles generally longer than the petiole, with entire or slightly undulate margin, pubescence similar to that at the stem, and evident veins, 3–5 cm. long, 2 cm. wide, thickly clustered on the branchlets, overlapping, almost concealing the inflorescence: flowers in close, somewhat pendent panicles terminating the branchlets; bracts linear, sessile, acute or obtuse, lowest about 1 cm. long, 3–4 mm. wide, spreading; bractlets at base of pedicels 2, white-membranous, orbicular, 2 mm. long; pedicels rose-colored, 3–5 mm. long, clothed with short, spreading white hairs: calyx with orbicular rose-colored divisions, glabrous, ciliate, 2 mm. long, incurved in anthesis, later revolute: corolla rose-colored, urceolate, 6 mm. long, 5 mm. in diameter at base, the divisions broadly orbicular, obtuse, obcordate, or erosely denticulate: filaments ciliate at the thickened base, pale rose-colored, the dark wine-colored anthers sub-orbicular, a little more than 1 mm. long, the curving horns 1.5 mm. long: ovary clothed with long, spreading white hairs: receptacle dark wine-colored: style terete, stigma greenish: honey abundant, giving a sweet fragrance to the flowers.

Collected by the author on Mt. Diablo, California, on the trail above the Boyd Ranch, February 22, 1903, in flower; in immature fruit May 30, the same year.

This belongs to the same group as *A. canescens* Eastwood. The rosy flowers, the glaucous foliage, and the branching roots are features in which the species are alike, but *A. auriculata* has leaves of a very different shape, branches more erect, and an appearance so different that they could never be confused by even the most superficial observer. In the shape and arrangement of the leaves and hairiness of stem the species resembles *A. Andersoni* Gray.

Cynoglossum Austinae sp. nov.

Stems about 5 dm. high, glabrous throughout, scaly at base: lower leaves suborbicular, 8 cm. in diameter; the other leaves oblong, acuminate, 8–12 cm. long, 4.5 cm. wide, undulate, decurrent on the broad petiole which varies in length from 13 cm. on the lowest leaves to 5 mm. on the topmost; upper leaves much smaller, ovate, upper surface glaucous, lower canescent with irregularly appressed pubescence: panicle somewhat contracted in flower, widely expanding in fruit; peduncles and pedicels glabrous, the latter filiform, lengthening in fruit: calyx deeply divided, the divisions linear-oblong, unequal, about 7 mm. long, 2 mm. wide, obtuse or acute, canescent: corolla purplish, the tube generally longer than the calyx, 7 mm., divisions oblong-orbicular, 4 mm. wide, slightly undulate; crests short, ligulate, conspicuous, truncate, 2 mm. broad and long: anthers almost sessile, nearly 2 mm. long, the tips exserted: only one or two nutlets maturing, these obovate or oblong, 1 cm. long, the lower part smooth or slightly wrinkled, the upper muricate with spines confluent, subulate, a few only tipped with stellate hooks.

Collected by Mrs. C. C. Bruce, the daughter of Mrs. R. M. Austin, in whose honor it is named, at Butte Creek, Calfornia, March and June, 1897, being *2092* of her collection.

It differs from the other California species in the peculiar nutlets. These are not at all flattened or depressed. The crests in the throat, too, are more conspicuous.

Cryptanthe trifurca sp. nov.

Stems diffusely branched from the base and above (occasionally simple in depauperate specimens), 1–1.5 dm. high, cinereous with stiff, white, horizontally spreading hairs 2 mm. long, also with appressed pubescence beneath: leaves linear, callous-tipped, strongly ribbed, becoming keeled, with thickened margins, 1–3 cm. long, 1–3 mm. wide, the pubescence like that of the stems

but with pustulate bases to the bristle-like hairs: inflorescence generally 3-forked, the spikes bractless with the flowers secund, subsessile, close but not crowded except when in bud, one flower in the forks: divisions of the calyx linear-lanceolate, obtuse, 3 mm. long, with pubescence like the leaves, connivent in fruit but with tips free, midrib keeled and very bristly: corolla white, salver-form, the limb 5.5 mm. in diameter, with orbicular divisions 2 mm. broad, the tube shorter; crests in the throat white, minutely papillate, slightly emarginate, each one distinct and with a smaller, rounder crest below on a level with the tops of the anthers: stamens inserted along the middle of the tube; filaments very short; anthers with cells united only near the middle: lower part of calyx-tube somewhat pubescent: nutlets 2–3 maturing, ovate, obtusely pointed, truncate at base, a little more than 2 mm. long, 1 mm. wide, mottled in two shades of brown, obscurely and sparsely papillate, very glossy; dorsal surface flattened, the groove on the ventral surface forked at base but closed throughout, ⅔ attached to the subulate gynobase.

Collected by Dr. Edwin Bingham Copeland at Klamathon, Siskiyou County, California, July 5, 1903 (*no. 3550* of Baker's distribution).

This species is nearest to *Cryptanthe ambigua* (Gray) Greene, but differs in habit of growth, being more erect and rigid, in the inflorescence, in the color and surface of the nutlets and the closed scar; the flowers are similar but the crests in the throat are not identical. The original figure of *C. ambigua*, which was described as *Eritrichium muriculatum* Torr. (Bot. Wilkes Exped. *pl. 13*), has no crests in the throat of the corolla-tube; the calyx-segments are more connivent, the nutlets are dull instead of glossy and the muriculations are more evident.

Phacelia eximia sp. nov.

Annual, about 3 dm. high, branching widely, with weak stems, clothed with fine white spreading bristles and glandular tomentum beneath: leaves compound, with generally one large leaflet at the end and 2 or 3 smaller ones below; terminal leaflet petiolulate, obovate in outline, deeply 3-lobed or undivided, laciniately crenate, hispid and glandular: peduncles flat, about the entire length of the leaf: racemes axillary from even the lowest leaves, spreading, 10–15 cm. long, the peduncle about ⅓ the entire length; bracts none, pedicels 1–2 mm. long: calyx with narrow, oblanceolate divisions, attenuate at base, loosely spreading, in flower 5 mm., in fruit

10 mm. long, 1 mm. broad near the top, filiform at the base, conspicuously hispid with fine bristles 3–5 mm. long: corolla purplish, veiny, funnel-form, 8 mm. long, the border almost 1 cm. across; lobes 2.5 mm. wide, not so long, broad and rounded; appendages 1.5 mm. above the base of corolla, attached their whole length, 1 mm., rounded at top, lunate at base: filaments attached at base to the appendages, filiform, together with the small brownish anthers and divisions of the style conspicuously exserted 5–6 mm.: style 1 cm. long, the branches 8 mm.; ovary globular, hispid like the calyx and glandular; ovules 4: capsule with two seeds, these brown, ovate, rounded on the dorsal side, keeled on the ventral, 2 mm. long, marked with shallow pits.

Type collected on Mount Wilson along the trail, Los Angeles County, California, by Fordyce Grinnell, Jr., December 31, 1903.

It is related most closely to *P. hispida* Gray, but is distinguished by the racemose instead of paniculate inflorescence, larger and more loosely scattered flowers, less dissected leaves, entirely different habit of growth, and the conspicuously exserted stamens and style. It is a lovely species, perhaps the most beautiful of the group to which it belongs.

Polemonium shastense sp. nov.

Stems cespitose from a multicipital caudex which is densely clothed with dead petioles, 7 cm. high: stems and leaves pale-green, glandular-pubescent: radical leaves 3–4 cm. long, the petiole gradually dilating downwards, 2 mm. wide at base, rose-colored; leaflets generally opposite, 15–21, ovate-orbicular but unequal-sided, punctate, about 2 mm. in diameter, slightly cuneate at base and narrowing abruptly to a short petiolule as broad as long; rachis channelled, 0.5 mm. wide; cauline leaves few, as many as the branchlets, similar to the radical leaves, but with shorter petioles: inflorescence cymose; peduncles slender, the lower much longer than the upper; pedicels 1–3 mm. long: calyx as long as the corolla-tube, 5 mm., campanulate, with oblong obtuse divisions 2 mm. long, a little more than 1 mm. wide: corolla funnel-shaped, white, veined and often tinged with pink, the throat yellow, the tube proper 2 mm. long, the throat 3 mm. long, hairy within, the oblong divisions 6 mm. long, 4 mm. wide: stamens and style exserted from the throat but not from the bud; filaments 4 mm. long, filiform, hairy at the insertion; anthers elliptical, obtuse, surpassing the stigmas: stigmas 2–3, a little more than 1 mm. long: capsule ellipsoidal, as long as the calyx-tube.

This was collected on Mount Shasta, California, altitude 3120 meters, July 16, 1903, by Dr. Edwin Bingham Copeland, and distributed by C. F. Baker, being his number *3515*, of 1903.

It comes under the aggregate *P. viscosum* Nutt., to which it seems closely allied, but as that has been an aggregate of many different forms it seems unlikely that this from Mt. Shasta can be the same as plants collected on the "Headwaters of the Platte."

Pentstemon Austini sp. nov.

Glabrous and pale-glaucous, stout from a woody stock, 5 cm. thick, branching from the base, almost a meter high: lower leaves oblong or ovate, on broad petioles as long as the blades, acute, sharply denticulate; upper leaves with shorter, broader petioles, the uppermost meeting but not perfoliate: thyrsus virgate, 3–4 dm. long, the cymes 2–4-flowered, distinct: peduncles and pedicels slightly and finely glandular-pubescent, the peduncles shorter than the unequal pedicels: sepals ovate-lanceolate, pink on the margins, 5 mm. long, slightly glandular, closely, longitudinally veined: corolla rose-colored with the tube slightly longer than the calyx, the throat abruptly dilated, 2.5 cm. long, slightly glandular; upper lip of 2 rounded lobes of half its length, lower with 3 spreading lobes, glandular within but not bearded: stamens glabrous, anther-cells confluent and explanate; sterile filament as long as the fertile, scarcely broadening at tip, glabrous: earliest capsules twice as long as the later ones, surpassing the calyx: seeds irregularly angled, black, glossy, minutely papillate.

Collected at Oak Creek, Inyo County, California, July 4, 1899, by Mr. S. W. Austin, in whose honor it is named, Number *1783* of the Death Valley Expedition, collected in the mountains of Inyo County, is the same. It differs from *P. spectabilis* Thurber, to which it is closely allied, by the simpler virgate inflorescence, the shorter tube of the corolla, the less dilated sterile filament, the anthers glabrous along the line of dehiscence instead of ciliate, and the smaller corolla. *P. floridus* Brandegee is probably nearer, but it differs also from this in the distinctly petioled radical leaves, the glaucous foliage, the longer tube of the corolla and different shape of the lobes, the divaricately spreading divisions of the anthers in bud instead of parallel; the corolla is also less ventricose below the opening.

Pentstemon macranthus sp. nov.

Perennial from a woody tap-root; stems about 8 dm. high, lower part glabrous and glaucous, upper glandular: lower leaves obovate-spatulate, tapering to broad connate-clasping petioles; upper cauline perfoliate, oblong to ovate, 1–1.5 dm. long, 4–6 cm. wide, irregularly and sharply denticulate, glaucous and glabrous: panicle narrow, interrupted, the short peduncles 2–3-flowered, 1 or 2 pedicels more than twice as long as the remaining one, from 3–15 mm.: sepals ovate, acute, 5 mm. long, membranously margined, glandular, wrinkled, overlapping: corolla rose-colored, 4 cm. long, the tube slightly curved, 1 cm. long, 5 mm. broad at base, the throat 15 mm. broad; upper lip 15 mm. long, with lobes 7 mm. wide, 5 mm. deep; lower lip with 3 rounded, spreading bearded lobes: sterile filament conspicuously exserted, hooked at the apex and densely bearded with long, yellow hairs; fertile stamens included, anthers and filaments glabrous: ovary shorter than the calyx.

Collected in IXL Cañon, Churchill County, Nevada, June 15, 1902, by Otto F. Heizer. It is closely related to *P. Palmeri* Gray, differing in the more contracted infloresence, smaller calyx, larger corolla, with tube more than twice as long as the calyx, the anthers without the ciliate edges on the expanded cells.

Pentstemon Grinnellii sp. nov.

Suffrutescent, stout, erect, green and glabrous throughout except the somewhat viscid-glandular inflorescence: lower leaves on broad petioles half as long as the blades, middle and upper subsessile, uppermost connate-clasping; lower leaves smaller than the upper stem-leaves, ovate-oblong or orbicular, sharply dentate, 1.5–4 cm. long, 1–2 cm. wide; upper ovate-acuminate, cuneate or cordate at base, about 8 cm. long, 2–3 cm. wide: panicle pyramidal, loose and open; peduncles 2–3-flowered the lateral pedicels half as long as the middle, twice as long as the calyx: sepals ovate-acuminate, 5 mm. long, with narrow, membranous margins, veins evident, closely longitudinally parallel: corolla cream-colored diffused with pink, the proper tube shorter than the calyx, abruptly dilated, becoming 2 cm. in diameter across the top; border spreading, 2-lipped; upper lip 1 cm. long, with 2 lobes 5 mm. broad and half as long; lower lip with 3 orbicular reflexed lobes separated from each other by an obtuse sinus, bearded in the throat: anther-cells confluent and explanate after dehiscence; sterile filament glandular-hirsute at base and up to the white bearded exserted tip.

Collected on Mt. Wilson, near Pasadena, California, June 6, 1903, by Fordyce Grinnell, Jr., in whose honor it is named as a mark of appreciation for a collectian of plants made on the mountain and given to the California Academy of Sciences. It is near *P. Palmeri* Gray, of which it may prove to be a variety. It is distinguished from that species by bright-green instead of glaucous foliage, and a shorter tube to the corolla, which is broader and shorter, and with two lips widely spreading.

Pentstemon anguineus sp. nov.

Stems branching at base, glabrous to the inflorescence: lowest cauline and radical leaves orbicular, ovate, or oval, tapering to petioles about as long as the blades, together 2–9 cm.; upper cauline leaves ovate-oblong, cordate or auriculate at the connate-clasping base, all serrate generally with the edges of the teeth revolute, the uppermost pair almost entire, upper surface bright-green, lower paler: inflorescence short, open-paniculate, densely glandular-villous, the hairs tipped with linear glands; bracts and bractlets ovate-lanceolate, glandular-villous; peduncles spreading, 5–10 mm. long, pedicels shorter; calyx campanulate, obtuse at base, 4 mm. long, the divisions acute or obtuse but not attenuate: corolla reddish-violet, 17 mm. long, the two lips separated by a broad sinus; the divisions of the upper lip oblong, rounded, half its length; lower lip longer than the upper, of 3 similar, slightly bearded divisions; tube about as long as the calyx, abruptly dilated to the throat, the entire corolla about 15 mm. long, half as wide: stamens included within the upper lip; sterile filament conspicuously exserted from the yawning mouth, conspicuously bearded at apex, less so below; anthers minutely scabrous externally, canescent within: ovary tapering to the filiform style, stigma capitate.

Collected near Shelley Creek on the Waldo-Crescent City road, northwestern California, growing in rather wet places at the base of cliffs and rocks, in bloom June, 1903. It is probably nearest *P. Rattani minor* Gray, but the flowers are larger, the leaves serrate and the sterile filament more conspicuously exserted. The corolla looks like the head of an aggressive snake, with open mouth and hairy tongue protruded.

Pentstemon scabridus sp. nov.

Shrubby at base, forming clumps, with numerous, slender, erect, virgate branches, 4–5 dm. high, scabrous-hispid throughout

and glandular especially above, old bark shreddy: leaves opposite, at base becoming alternate, ovate, dentate, acute, 1 cm. or less in length, 3–5 mm. wide, appressed somewhat to the stem: flowers solitary in the upper leaf-axils on very short peduncles, bracted at base, the 2 lanceolate bracts about as long as the sepals: sepals lanceolate, 4 mm. long: corolla ochroleucous tinged with pink, glandular, the tube twice as long as the calyx, dilated but little at the throat; upper lip erect, obcordate, lower with 3 oblong, reflexed, undulate lobes: stamens and style equaling the upper lip, glabrous; sterile filament filiform, much shorter, glabrous; anthers with cells confluent but not explanate: capsule lanceolate-acuminate in outline, shorter than the sepals.

Collected by the author on dry hills near Kern Lakes and on the Hindman's Trail over Coyote Pass, Tulare County, California, July 19, 1903. This species is peculiar in *Pentstemon* in having single-flowered peduncles so short that the flowers appear sessile. It really looks unlike a *Pentstemon*, and at first I was inclined to set it by itself.

Pentstemon Berryi sp. nov.

Stems woody, branching from woody rootstock, 1–2 dm. high, lower part puberulent, upper glandular-hairy: leaves rather thin, lower elliptical-oval and oblong, tapering to a short petiole, 1–3 cm. long, 8–12 mm. wide, serrate above the base, mucronate; upper cauline leaves sessile, acuminate, with fewer marginal teeth: peduncles 1-flowered, erect, 5 mm. long: sepals lanceolate-attenuate, 12 mm. long, sparingly ciliate and glandular-hairy: corolla red, 3 cm. long, glabrous externally, lower lip bearded with long white hairs extending from the base of the 3 rounded divisions half down the tube; upper lip glabrous within, erect, the two deltoid obtuse divisions less than half its length, with undulate margins: stamens included; filaments glabrous; anthers long-woolly; sterile filament yellow-bearded for more than half its length, thickest at apex: capsule only 1 cm. long.

Collected by the author at the head of Cañon Creek, Trinity County, California, July 12, 1901. It is named in honor of my friend, Mr. S. Lucien Berry, without whom the trip to this inaccessible region would have been unsuccessful. It is a beautiful species allied to *P. Menziesii* Hook., from which it differs in the greater size of the flowers, the red instead of violet corolla, the taller stems, and the more serrate and thinner leaves. The flowers are more like *P. Davidsonii* Greene, but the appearance of the

plant is entirely different and the flowers have the color of those of *P. Newberryi* Gray. There is a specimen collected by Harley P. Chandler near Marble Mountain, Siskiyou County, California, *no. 1599*, which appears to be the same. It was distributed as *P. Menziesii Newberryi*. It resembles this only in the color of the flowers.

Orthocarpus maculatus sp. nov.

Stems slender, with few slender branches, appressed-villous and minutely scabrous: leaves ovate, entire, obtuse, sessile, 1–1.5 cm. long, 3–5 mm. wide: flowers in slender spikes becoming 1.5 dm. long, lower ones more scattered, bracts shorter than the flowers, oblong, 1 cm. long, irregularly 3-toothed or lobed, thin; upper ones yellowish-white at tip: calyx with attenuate almost equal divisions longer than the tube, together 10–12 mm., glandular-hairy: corolla cream-colored, with a few black-purple spots on the lower part of the sacs, glandular; upper lip straighter, obtuse, the broad stigma barely exserted; lower lip with sacs longer than wide, the 3 teeth half as long as the galea: capsule narrowly oblong, light brown: seeds dark with a loose, membranous, reticulated, thin coat.

Collected by the author at Fort Bragg, Mendocino County, California, Aug. 9, 1902. It is to be placed near *O. lithospermoides* Benth., and belongs among the closely related species which differ generally chiefly in the shape of the corolla.

Orthocarpus Brownii sp. nov.

Annual, simple or branched, 1–2 dm. high, purplish below, becoming white above, clothed with soft, spreading, white, jointed hairs: leaves with 3–5 narrowly linear, ribbed divisions, narrower than the rachis, attenuate, erect, spreading: bracts flabelliform, with ovate rachis and 10 divisions, the whole 1–2 cm. wide, 5–10 mm. long, densely villous with long hairs and with a short glandular integument beneath: flowers in dense spikes, the earliest somewhat scattered, the lateral spikes shorter than the main one, this in branching plants becoming 1 dm. high but in simple-stemmed plants shorter: calyx thin, becoming inflated, white tinged with green, villous and glandular-hairy; the 4 linear, triangular-attenuate divisions almost equal, 3.5 mm. long; tube globose-ovoid, in fruit surpassed by the capsule: corolla yellow, glandular and villous, the tube surpassing the calyx, 8 mm. long, broadening at base and throat, narrowed near the middle; upper lip straight, acuminate, surpassing the lower, 5 mm. long from the

throat; lower lip much inflated, the 3 sacs as broad as long, 4 mm.: stigma included at first, later exserted, unequally 2-lobed: ovary glabrous, ovate in outline: seeds numerous, irregularly obovate, with white, cellular coats.

Collected by H. E. Brown at Pitt River, Shasta County, California, *no. 220*. The best specimens are those of Brown and Heller, *no. 5459* (type), collected in Berry Cañon near Clear Creek, Butte County, California. There are specimens in the herbarium of the California Academy of Sciences from Mrs. C. C. Bruce, collected at Little Chico, *no. 2088*; also from Big Meadows, collected by Mrs. Austin in 1882.

Orthocarpus noctuinus sp. nov.

Annual, about 2 dm. high, slender and with slender, upwardly spreading, somewhat cymose branches, cinereous-puberulent: leaves narrow, attenuate to a filiform apex, simple or with two filiform divisions, longest leaves about 6 cm.: inflorescence of main stem an oblong spike with lowest flowers scattered, that of the branches becoming subcapitate; pedicels scarcely evident; bracts crimson-tipped, with 3–5 filiform divisions shorter than or equaling the calyx, the broad lower part 3-nerved: calyx with four narrowly linear divisions, deeply cleft on the dorsal side, front about half as long as the slender purplish tube: corolla with long tube, 12 mm. below the swell of the throat, woolly, tinged with rose-color, throat white; galea broadly subulate, straight, rose-colored, pubescent; lower lip ventricose, trisaccate, each sac with 2 folds, yellow banded with crimson, and with crimson dots in the intervals between the folds, the 3 involute lobes colored like the galea and surpassing it, the middle lobe longest, narrowly deltoid, mucronate: filaments and style glabrous: stigma globose-capitate, purplish-black: ovary linear-oblong.

Collected by the author at Inverness, Marin County, California, on the hills back of the settlement, May 6, 1901. It is near *O. densiflorus* Benth., but differs in its more loosely branched habit, more slender stems, and longer flowers, and in the great length of the lower lip. In *O. densiflorus* the lower lip is shorter than the galea and the spike is more densely flowered. It is named because of the appearance of an owl produced by the markings on the corolla. This also occurs in *O. densiflorus*, and is the reason of the name owl's clover which has been applied to the latter species.

Orthocarpus falcatus sp. nov.

Slender, simple, erect, 1–2 dm. high, villous throughout: lower leaves narrowly linear, 2–3 cm. long, 1 mm. wide; upper stem-leaves with 3 divisions similar to the lower leaves and extending to within 5 mm. of the sessile base: lower flowers scattered, pedicellate in the axils of the upper leaves or leaf-like bracts; pedicels erect, 1–5 mm. long; upper flowers subsessile, forming a subcapitate cluster; bracts similar to the upper leaves but shorter and broader, surpassing the flowers: calyx with linear-attenuate divisions, 5 mm. long, as long as the tube; this becoming inflated and papery, equaling the ovary: corolla hispid with short pubescence, the slender tube barely surpassing the calyx; upper lip falcate, 2 mm. longer than the lower; lower lip with 3 sacs longer than broad, hairy within, the 3 teeth very small: stigma not exserted: pod light-brown, elliptical: seeds many, brown, with loose, membranous, reticulated coat.

Collected on Smith or Palomar Mountain, at an elevation of 1500–1800 meters, San Diego County, California, June 1–4, 1891, by S. B. Parish. It was distributed as *O. hispidus* Benth., to which it is allied, but has flowers more slender and with falcate or curved galea.

Castilleia Clementis sp. nov.

Stems many from a woody root, virgately branched, about 2 dm. high, densely white-tomentose throughout: leaves crowded and fascicled generally up to the dense spike, thick, linear, simple or some with a pair of linear lobes perpendicular to the rachis, obtuse, subterete when young, 1–3 cm. long, 1–2 mm. wide: spike ochroleucous, 5–10 cm. long; lowest bracts similar to the leaves in color, texture and pubescence, pedately 3-parted, the two lateral divisions 8 mm. long, the middle often 3-cleft at apex; upper bracts with broader rachis and divisions more spatulate and broader, less tomentose and tipped with yellowish-white: calyx 9 mm. long, cleft equally a little above the middle into 2 entire divisions 4 mm. wide, truncate along the apex but with rounded angles, 2-veined, tomentose externally, puberulent within, ochroleucous: corolla with the tip of the broad galea exserted 1–2 mm.; tube greenish, 4 mm. long, a little more than 2 mm. in diameter; lower lip short, not protuberant, dark-green, the two outer teeth larger than the middle and much less incurved; upper lip 5.5 mm. long, 3 mm. wide at the throat, almost 2 mm. at the rounded top, lower part with thickened margin, sides 1-nerved, keel thickened, glandular-puberulent: style rather thick, the capitate stigma exserted: stamens with short glabrous filaments and slender anthers:

capsule ovate-oblong, unequal-sided the coat thick and tough, brown, glabrous, tipped with the base of the style: seeds somewhat cuneate in shape, with a white membranous favose-reticulate coat.

Type collected at Carmel by the Sea, Monterey County, California, June 16, 1904, by Gwendolan Newell. The species was discovered a short time before by Mrs. Joseph Clemens, whose enthusiastic love of the wild flowers this peculiar species will commemorate. It is related to *C. foliolosa* H. & A., but has an entirely different corolla.

Antirrhinum ovatum sp. nov.

Annual, simple or branching diffusely from the base, 1–3 dm. high, glandular-hairy throughout with spreading hairs, flowering from almost the lowest axils: leaves ovate, sessile or the lowest short-petioled, truncate, retuse or obtuse at the apex, which has a spot destitute of the dense glandular hairs that clothe the rest of the surface, 1–2 cm. long, 0.5–1 cm. wide: flowers axillary on short peduncles not so long as the calyx: divisions of the calyx unequal, four linear, acute, 5 mm. long, 1 mm. wide, the fifth foliaceous, elliptical, 10–12 cm. long, 5 mm. wide: corolla rather large, with widely open throat, the upper lip pink, lower white; tube curved, prominently saccate at base, widening abruptly to the throat, about 7 mm. long, 4 mm. broad, throat ample; upper lip 8 mm. wide, of two rounded lobes; lower lip reflexed, with smooth palate and 3 short, rounded, reflexed lobes: stamens hairy at the insertion at the base of the tube, otherwise glabrous, the two shorter ones free, the other two united by the thick anthers; ovary and lower part of style glandular-hairy, the upper part smooth, broader: fruit tipped with the persistent style: seeds cuneate, rugose and the rugae muricate.

Collected by the author on the Carisa Plains, San Luis Obispo County, California, and the hills adjacent to the Painted Rocks, June 12, 1902.

It grew in the somewhat alkali soil, and has the slight odor of carrion so often found among such plants. While it is larger-flowered than any other California species, it is an unattractive-looking plant. It has the short branchlets that look as if they might be tortile and prehensile if there was anything to cling to, but none of the specimens observed possessed the habit or perhaps the chance.

Antirrhinum emarginatum sp. nov.

Annual, erect, diffusely branching from or near the base, 2 dm. high, leafy, viscid-pubescent throughout with spreading hairs: leaves alternate or the lowest occasionally opposite, obovate, oblong, or oblanceolate, the upper ones induplicate, entire, tapering at base to a short petiole, the apex obtuse but with a conspicuous notch subtended by a peculiar gland forming a gusset; lowest leaves 6 cm. long, 2 cm. wide, the upper 2 cm. long and 6 mm. wide: flowers solitary, axillary on short peduncles: sepals distinct, unequal, similar to the upper leaves but smaller, about 7 mm. long, 12 mm. wide, the notch filled by a gland similar to that on the leaves: corolla almost 1 cm. long, pale-lilac to white with sulphur-yellow saccate palate; spur rounded, saccate; tube widening upwards, 5 mm. long; upper lip 2-parted, or obcordate, 7 mm. wide; lower lip very broad, deeply 3-parted, each part 4 mm. across: stamens 4, attached near the base of the tube, included, the longer pair of filaments obliquely dilated at apex, 3 mm. long, the shorter pair a little more than 2 mm. long, scarcely dilated at top; anthers perfect and 2-celled: style stout, hairy, sparingly glandular, 3 mm. long, about twice the ovate ovary: fruit and seeds unknown.

Collected near Fresno, California, on ploughed river bottomland, May 15, 1904, by Mr. Charles E. Jenney. It comes nearest to *A. leptaleum* Gray, but is widely different in all its parts. The peculiar apices of the leaves readily distinguish it from all other species.

Collinsia brachysiphon sp. nov.

Stems low, 4–6 cm. high, branching generally from all the leaf-axils even the cotyledons, almost glabrous below, the inflorescence puberulent and slightly glandular: cotyledons oblong-spatulate, the blades about as long as the petioles, together 15 mm., entire, obtuse, glabrous except for the puberulent petioles; upper leaves linear-lanceolate, tapering to a sessile clasping base, 1–3 cm. long, 2–4 mm. wide, obtuse, entire, in two or three pairs: from the top pair of leaves spring two or three flowers on slender pedicels that become nodding in fruit, also a corymb containing few flowers which apparently become verticillate in fruit, with linear-subulate bracts: calyx-divisions lanceolate-subulate, obtuse, slightly unequal, 2.5 mm. long, thickened at the apex and on the margins, almost twice as long as the campanulate tube: corolla small, purple, the tube 1 mm. long and a little wider, the gibbous throat twice as long as wide; upper lip deeply cleft with oblong, rounded spreading lobes; lower lip with the lateral divisions almost twice

as long as the obtuse keel, darker in color: stamens with small cordate anthers and glabrous, filiform filaments; abortive stamen small, sessile, yellow: ovary conical, tapering to the style, which is 4 mm. long: capsule slightly surpassing the calyx, globular, acuminate at apex, minutely papillate: seeds 2, semi-obovate, almost 3 mm. long, completely filling the cavity, minutely papillate.

Collected by the author at Summit, Placer County, California, June 8, 1898. It differs from *C. parviflora* Lindl., which grew in thesame locality, in leaves and inflorescence, and in color and shape of corolla; and the gland-like, yoke-shaped protuberance at the opening of the throat of *C. parviflora* is replaced by a wart-like protuberance at the base of the lateral divisions. *Collinsia inconspicua* Congdon is also related, but is a much larger plant, having the corolla of a different shape and color, the calyx-lobes longer and the inflorescence different.

Chrysoma Merriami sp. nov.

Low, spreading, suffrutescent, glandular-punctate: leaves crowded, obovate, sessile, entire, 1.5 cm. long, 1 cm. wide, callous-mucronate at apex, acuminate at base, rather thick, the midvein only plainly evident: heads few, but closely clustered at the ends of the branchlets on short, bracted pedicels, the entire cluster almost sessile; bracts small and thick, orbicular to spatulate, less than 1 mm. long: heads rayless, 1 mm. long; involucre turbinate, the scales in several series, the outer successively shorter, merging into the bracts, glandular, linear, acute, less than 1 mm. long; inner 5 mm. long, keeled and tipped with brownish-green, membraneously margined, the acute apex ciliate, somewhat recurved-spreading in anthesis: corolla glabrous, tubular, gradually tapering from a slender base, 5 mm. long, teeth acute with thickened margins that become striae on the tube: anthers exserted 2 mm., the tips sharply pointed: style-branches hairy, exserted: akenes slender, 2.5 mm. long, clothed with upwardly-appressed silky white hairs; pappus about as long as the corolla, minutely barbellate.

Collected by Dr. C. Hart Merriam at Caliente Creek, Kern County, California, October 12, 1902, and named in his honor. It is nearest to *C. cuneata* Greene, differing chiefly in larger leaves and heads, and less densely hairy akenes.

Chrysoma fasciculata sp. nov.

Suffrutescent, viscid throughout except on the older stems: leaves fascicled, terete, mucronate, 1–1.5 cm. long: branchlets

terminating in 1–4 heads on short, bracted peduncles: heads 1–1.5 cm. high, about 20-flowered, the 1–2 rays entire or deeply toothed; involucral scales in several series, the outer successively shorter, spreading and somewhat recurved; outermost 2–3 mm. long, green tinged with brown, glandular; inner linear, acute, 8 mm. long, brownish-green, glandular, membranously margined, apex erosely ciliate; disk-flowers tubular, gradually enlarging, the lower part glandular, upper part glabrous, striate, teeth 5, triangular with thickened margins and tips conniving around the slender hairy exserted style-branches: stamens included: akenes 5 mm. long, densely clothed with silky-white, loose, upwardly-appressed hairs; pappus subrufous, abundant, 1 cm. long, minutely barbellate.

Collected along the coast near Monterey, California, by Dr. E. K. Abbott, August 25, 1904, also the same year by Dr. C. Hart Merriam on Carmel Bay, October 11. The heads are larger than any of the genus. Externally it most resembles *Chrysoma pinifolia* (Gray) Greene, but the corollas are shaped differently, *C. pinifolia* having the teeth recurved-spreading and with almost glabrous akenes. Dr. Merriam reports it as extremely abundant, growing amid such shrubs as *Eriogonum fasciculatum*, *Lupinus Chamissonis*, and others found in similar situations.

Raillardella scabrida sp. nov.

Stems several from a thick, woody root, about 2 dm. high, leafy, scabrous with bristly pubescence, the upper part beset with black, stipitate glands: leaves alternate, linear, obtuse, sessile, 10–15 mm. long, 1–4 mm. wide, the lower ones cinereous from the white bristles thickly clothing the scabrous surface, uppermost dark from the blackish glands: heads solitary or more often 2 or 3 terminating the stems, the middle peduncle almost naked, the lateral with few bracts near the base, both rough with the dark glands, about 6 cm. long: heads eradiate, 15 mm. long; involucral scales linear-lanceolate, acute, scabrous and glandular, densely white-ciliate along the upper half, 8 mm. long, 1.5–2 mm. wide, reflexed-spreading to the very base, in fruit becoming convex on the outer side; outer flowers fertile, inner mostly sterile: corolla yellow, tubular, 6 mm. long, less than 1 mm. in diameter, uniform, the teeth with thickened margins: anthers surpassing the corolla: styles with long, slender exserted bristly tips: pappus-bristles plumose, the shaft of the feather flat, as long as the corolla-tube; akenes black, densely clothed with white, closely appressed hairs, broadening towards the top, keeled on one side, flattened and

ribbed on the other, about 6 mm. long: receptacle flat, dotted at intervals with the circular scars left by the fallen akenes.

Type collected on Snow Mountain, California, August 25, 1892, by Mrs T. S. Brandegee. It is related to *R. Muirii* Gray, and seems so unlike the other members of the genus as to justify the section and almost a distinct genus.

Hieracium Grinnellii sp. nov.

Perennial with fleshy-fibrous roots: stem paniculately branched, few-leaved, slender, 6 dm. high: radical leaves forming a somewhat rosulate cluster at base of stem, oblanceolate, tapering to a broad petiole, densely clothed with long, white, barbellulate woolly hairs, repand-denticulate or entire, obtuse or acute, blade and petiole together 5–8 cm. long, viscid and hairy; cauline leaves few, linear-acuminate, diminishing upwards, sessile, entire or with two or three barely perceptible teeth, 2–4 cm. long, 2–5 mm. wide, tomentose-puberulent and somewhat glandular: panicle with few, widely spreading branches; heads few, on spreading pedicels 1–3 cm. long; bracts almost filiform, especially the short ones below the involucres, glandular-puberulent: heads 15 mm. high, the scales of the involucre in three series, the outer less than half as long as the inner, linear-attenuate, densely glandular-hairy, inner scales 1 cm. long: rays yellow, 8 mm. long, tipped with 4 narrow teeth: styles glandular, conspicuously exserted; stigmas short: pappus about as long as the involucre, barbellulate, white but slightly tawny at base, glabrous.

Type collected at Arroyo Seco near Pasadena, California, Sierra Madre mountains, December 22, 1903, by Fordyce Grinnell, Jr., in whose honor it is named. It is related to *H. argutum* Nutt. and *H. Parishii* Gray. It has the habit of *H. albiflorum* Hook., but the yellow rays of the other two species.

Lessingia albiflora sp. nov.

Divaricately spreading like a tumble-weed, about 1.5 dm. high and 3 dm. across: radical leaves dried so as to be unrecognizable but with traces of tomentum, stems and cauline leaves glandular-punctate: ultimate branchlets slender, rigid, straight: leaves induplicate, cordately clasping, ovate-acuminate, sometimes slightly aristate, the uppermost merging into the bracts, the margins edged with short tack-shaped glands, the lower leaves 8 mm. long, 4 mm. wide, recurved: branchlets terminating in one or two small heads, 8 mm. high on very short, closely-bracted pedicels: involucral scales in several series, the outer successively shorter and merg-

ing into the bracts, about 1 mm. long, green and glandular except at the chartaceous base, the inner linear, keeled, 4 mm. long, white or purplish, chartaceous except for the green, glandular spot at the triangular-acute apex, the glands all tack-shaped: flowers white, about 8 in each head: akenes obconic, densely pubescent with upwardly appressed hairs: pappus rather coarse, rufous, barbellate, unequal, the longest bristles about equaling the corolla-tube.

Collected by the author near Rose Station on the road between Tejon Pass and Bakersfield, Kern County, California, October 3, 1894. It is distinct from all other species in habit and color of flowers, but in general seems most like *L. glandulifera* Gray.

CALIFORNIA ACADEMY OF SCIENCES.

A new Botrychium from Jamaica*

WILLIAM RALPH MAXON

(WITH PLATE 6)

The systematic status of the members of the group of *Botrychium ternatum* has been the subject of a good deal of comment within the past ten years. Naturally there have developed legitimate differences of individual judgment and interpretation: and, while in one or two instances the results offered have been such as to suggest doubt that the author was in actual possession of some of the forms under discussion, it is probably true that no two students working with the same series of specimens would arrive at conclusions absolutely identical. It becomes often an exceedingly difficult matter to decide whether a given series of plants — and too often a small series — constitutes a sufficiently marked and coherent assemblage to stand apart, specifically distinct, from an obviously related form; or, whether, on the other hand, it is to be regarded as a mere local variation induced, it may be, by habitat.

Of the so-called species recently recognized,† several — and they are, in the opinion of the writer, very few in number — do not appear to be valid species in the ordinary sense of the term: they lack distinctive diagnostic characters and pass insensibly into another form. And, it must be confessed, a study of the entire group must of necessity be more truly comparative and involve a wider view than is usually to be required in most groups of pteridophytes. But the fact remains, that there *are* distinct groups, inhabiting definitely restricted areas and comprising individuals in close agreement in habital and foliage characters, which offer comparatively small but absolute differences from allied groups of individuals from other regions; and it appears to the writer that, unless reduction of the most sweeping sort is to be made, it is

* Published by permission of the Secretary of the Smithsonian Institution.

† Underwood, An index to the described species of *Botrychium*. Bull. Torrey Club 30: 42–55. Ja 1903.

undoubtedly the most logical proceeding to recognize these as species and to designate them as binomials. The recognition of subspecies implies or ought to imply the existence of specimens showing the transition from the typical form to the subspecific center of variation. In two or possibly three instances among the recently recognized "species" referred to above, such intermediates seem to exist, and the writer hopes to discuss these later at greater length; but in the majority of cases intermediates (if existent at all) have not found their way into the herbaria, and the supposed justification for the reduction practiced by several American writers appears to be contained in the fast disappearing fallacy that the sum of the differences and not their constancy is the criterion for specific segregation, — a logical pursuit of which principle would lead by no very circuitous route to the treatment accorded the group by Hooker and Baker.

The plant here to be described is not associable specifically with any described form. It may very appropriately bear the name of one whose studies must necessarily prove largely instrumental in a final elucidation of this perplexing group.

Botrychium Underwoodianum sp. nov.

Plant of large stature (3 dm.), to be placed between *B. Jenmani* and *B. decompositum* of the *ternatum* group. Roots copious, stout, cordlike, corrugate above, fasciculate from a short (1–2 cm.) underground prolongation of the axis: common stalk short (about 2 cm.), bud densely covered with a compact growth of silky hairs: sterile division short-petiolate (5–10 cm.), 12–20 cm. broad and nearly as long, commonly pentagonal in shape, tripinnate, the basal pinnules of the lowermost lateral divisions usually much elongated and again deeply pinnatifid; ultimate segments relatively very large, bluntly obovate or broadly spatulate, the margins evenly and finely crenate-dentate with an occasional shallow lobation; texture slight, resembling that of *B. obliquum*; venation manifest: sporophyl about 30 cm. long; panicle rather lax, about 8 cm. long, bipinnate; sporangia large, sessile.

JAMAICA. — Type in the herbarium of the New York Botanical Garden, Jenman collection. Co-type in the U. S. National Herbarium (*no. 521103*). Of the several specimens collected by Jenman only one is fertile; and thus, though smaller than usual and less characteristic in the outlines of the sterile division, is here figured

as the type. Other Jamaican specimens are: *Underwood 179* and *2620*, *Maxon 1573*, and *D. E. Watt* (U. S. N. M. *520982*), all from the vicinity of Cinchona, altitude about 1500 meters; and two specimens in the herbarium of Capt. John Donnell Smith, communicated by Hart. The last, though indicated by Dr. Christ as representing a new species, were not described, presumably on account of their immature condition.

The series at hand indicates that *B. Underwoodianum* is one of the most distinct species in the *ternatum* group. As stated, it appears to be most nearly related to *B. Jenmani* Underw.* and *B. decompositum* Mart. & Gal.† From the former it differs conspicuously in its greater size and more delicate texture; and from the latter imperfectly known species very noticeably in the following distinctive characters: (1) the peculiar shape and spacing of the segments, and (2) the wide divergence of the main divisions which spread ordinarily at an angle of nearly or quite ninety degrees, There is, moreover, in most specimens so pronounced a basiscopic development of the first lateral division as to give a decided pentagonal shape to the leaf, though this feature is not especially noticeable in the type specimen.

The type measures 13 cm. in width; others 20 cm. The illustration is at two thirds natural size and represents the type, therefore, on the printed page at less than one half the actual dimensions frequently attained by individuals of this species.

The small figure at the right represents a bud (exposed) in the enveloping hollow base of a sterile plant (Jenman collection). The upper bud is quite the same and is produced upon nearly all the sterile plants at a point from which the sporophyll would normally have had its origin.

UNITED STATES NATIONAL MUSEUM.

* Fern Bull. **8**: 59. 1900. (Type from Jamaica.)

† Mém. Acad. Sci. Brux. **15**[5]: 15. *pl. 1.* 1842. (Type from Mexico.)

Explanation of plate 6

BOTRYCHIUM UNDERWOODIANUM sp. nov.

Type specimen, at two-thirds natural size. The detailed drawing showing buds is from a second specimen in the Jenman collection; two-thirds natural size.

Notes on the zygospores of certain New England desmids with descriptions of a few new forms

JOSEPH AUGUSTINE CUSHMAN

(WITH PLATES 7 AND 8)

While desmids in their ordinary vegetative condition are very common, they are much less frequently found in conjugation. When found in this condition their characters are always worthy of notice. The zygospores of a considerable number of American species have been figured by Wolle and a few by later writers on American desmids, but there are many species of which the zygospores are as yet unknown. In many cases the figures given by Wolle have been found inaccurate by later writers. The formation of zygospores, aside from its comparative rarity, is always an interesting process. There appear to be various stages in the formation of the spines, as well as other characters, which need more attention to be fully understood.

A close study of the zygospores of various desmid groups should reveal something concerning relationships and should determine somewhat the validity of one or the other of the two classi-classifications, one based on form alone, the other on arrangement of cell-contents. This should be especially true in the relationships of various groups within the genus. On the other hand, certain species which are almost exactly alike both in external form and structure of contents have zygospores which are widely different in character. Whether such forms should be separated on the basis of differences in the character of their zygospores, representing fruiting conditions, or should be kept close together on the basis of similar form and structure in their vegetative state, is a question to be settled by extended work upon the zygospores of a considerable number of species.

Whether the zygospores of a single species are always constant in their characters is also somewhat of a question. If they are

not constant, their use as a basis for any sort of division is at once seen to be valueless.

The following forms were found in collections made at Pondville, in May, 1903; South Framingham and Reading, Mass., May, 1904. The first two collections were made by the writer, and the last by Mr. G. A. Fisher.

CLOSTERIUM DIANAE Ehrenb. PLATE 7, FIGURES 1–3.

In the series shown, certain definite steps are represented. In *fig. 1* the two cells have each broken apart and their contents extruded and united. At this stage it consists of two portions: an outer clear, hyaline mass and an inner more dense portion with many chlorophyl-granules and oil-globules. The outer margin of the clear mass forms a perfect sphere. In the breaking of the cells in the beginning there may be three conditions. They may open as in *fig. 1*, but leaving no definite line of breakage across the cell, looking at first glance as if it were more of a stretching than an actual break. This condition was frequently noted.

In the second condition, as in *figs. 2* and *3* (the lower cells), there may be a definite break in the middle, but the two parts remain attached to one another. In the third case, as in the upper cell of *fig. 3*, the two portions become entirely separated. This last stage is interesting when compared with the following species.

In the next stage in the formation of the zygospore (*fig. 2*), the mass containing the chlorophyl is gathered together at the center, forming a spherical mass about which the hyaline portion forms an outer covering. At this stage it is considerably smaller than at first (*fig. 1*). In the final stage the chlorophyl mass remains about the same size as in *fig. 2* and the outer portion forms a thickened wall.

Specimens in all these three stages were very common in the material collected by Mr. Fisher at Reading.

Diameter of the completed zygospore, 36–40 μ.

CLOSTERIUM LINEATUM Ehrenb. PLATE 7, FIGURES 4–6.

In this species there are two things of especial interest when compared with the foregoing. The cells are completely separated and the semicells resulting adhere in a peculiar manner to the outside of the hyaline mass, extending directly outward from the sur-

face. This condition is more like the third case mentioned under *Closterium Dianae*, but there the semicells do not adhere in the peculiar manner of this species. Wolle does not show this character in either of his figures of fruiting specimens of this species. All the specimens seen had this character.

The second character is the variation in the production of either single or twin zygospores, the latter condition being much the more frequent. With the exception of the above characters the stages are comparable to those seen in the preceding species. Fruiting specimens of this species were also abundant in the collection from Reading.

Diameter of completed zygospore, 78 μ.

MICRASTERIAS PAPILLIFERA Bréb. PLATE 7, FIGURES 7, 7a.

The zygospore of this species was figured in Ralf's British Desmids, and that I believe is the only original figure of the species in its fruiting condition. The zygospore is large with fairly large and stout spines, many of them bifurcate at the tip. Just before the spore is fully formed there is a gelatinous covering which extends partway out upon the spines. This disappears as the zygospore reaches completion, entering probably into the formation of the covering. The form of the zygospore is not exactly spherical, but slightly elongated.

Lat. zyg. s. sp. 75 μ; c. sp. 95 μ; long. zyg. s. sp. 75 μ; c. sp. 103–105 μ.

Common in the material from Reading.

PENIUM CLEVEI CRASSUM W. & G. S. West. PLATE 7, FIGURE 8.

This variety was found to be common in the material from Pondville, making the first record for it in America. The zygospore both of the typical form and of the variety has hitherto been unknown. It is spherical with numerous, broad, squarely truncated spines as in the figure. The cells in the figure have not the roughened apices which, however, they do possess in the specimens.

Long. cell. 80–84 μ, lat. 40–44 μ: diam. zyg. c. proc. 68–78 μ, s. proc. 54–57 μ.

Cosmarium pseudoorbiculatum sp. nov. PLATE 7, FIGURE 9.

This species has been confused with *C. orbiculatum* Ralfs. It is evidently the same as that figured and described by Delponte

as *C. orbiculatum* (Memor. R. Accad. Sci. Torino II. **28**: 11 (107). *pl. 7, f. 46–48.* 1877), agreeing exactly in form and size. The form of the semicells is more oval in front and end view than in Ralfs' species and may in this way be best distinguished. But the zygospore is very different, holding a place distinctly apart from the usual type of *Cosmarium* zygospore. That of *C. orbiculatum* is spherical with the usual type of short conical spines. In the present species it is a decided oblate spheroid, on one end evenly convex, on the other concave in the middle forming a distinct pit of considerable size. The zygospore has from sixteen to twenty lamellar plates extending from pole to pole, evenly scalloped, each plate with about ten spines broadly elliptical at the base, becoming circular at the broadly truncated apex. The portions between the lamellae are indistinctly striate. Altogether this forms a very curious type of zygospore for this group.

Long. 40 μ, lat. 28 μ, lat. isthm. 6.5 μ, crass. 21.5 μ.

Long. zyg. c. sp. 34 μ, lat. zyg. c. sp. 50 μ.

Common in fruiting condition at Pondville, Mass.

Sphaerozosma readingensis sp. nov. PLATE 7, FIGURES 10, 10*a*.

Sphaerozosma, smooth, without exterior ornamentation, sinus deep, somewhat gaping, end view broadly elliptical, semicells in side view nearly circular, in front view nearly three times as wide as long; cells connected by two glandular processes with a third projection between them in the middle of the end of the semicell (*fig. 10a*).

Zygospore much like that of *S. Aubertianum* figured by W. and G. S. West, with fairly long acicular spines.

Lat. cell. 28 μ, long. 22 μ, lat. isthm. 6.5 μ.

Lat. zyg. s. sp. 25 μ, lat. zyg. c. sp. 52 μ.

Common in the collection from Reading, Mass.

STAURASTRUM BREVISPINUM Bréb. PLATE 8, FIGURES 12, 13.

In *figure 12* is shown an early stage in the formation of the zygospore. There is a central mass, green in color, surrounded by an outer hyaline covering. At the stage figured this consists of two distinct portions, the inner one of which evidently becomes the main wall of the zygospore, while the outer one is used up in the development of spines.

Figure 13 shows the completed zygospore of the same species.

Lat. cell. c. sp. 38 μ, s. sp. 32 μ, lat. zyg. s. acul. 32 μ, lat. zyg. c. acul. 72 μ.

This species was very common in a fruiting condition at South Framingham, Mass.

Staurastrum brevispinum basidentatum var. nov. PLATE 8, FIGURE 11.

Differs from the typical form in having three teeth at the base of each semicell. The zygospore is much like that of the usual form (*fig. 13*), but is somewhat smaller and has fewer spines.

Frequent at Pondville, Mass.

STAURASTRUM DILATATUM Ehrenb. PLATE 8, FIGURE 14.

The small specimen here figured seems best referred to this species. The zygospore is elliptical, covered with rounded protuberances. Whether this was the completed form of the zygospore or not was not fully determined.

Lat. cell. 22 μ, long. zyg. 28 μ, lat. zyg. 22 μ.

This small species was found in a fruiting condition at Reading, Mass.

STAURASTRUM GRANDE Bulnh. PLATE 8, FIGURE 17.

Figure 17 represents the typically punctate form of this species. The zygospore is large, angular, with broad, often somewhat curved spines, scattered sparsely over the surface. As far as I am aware the zygospore of this species has not been figured.

Lat. cell. 65–85 μ, lat. isthm. 12–14 μ: lat. zyg. s. sp. 60 μ, lat. zyg. c. sp. 100 μ.

Found occasionally in the collection from Reading, Mass.

Staurastrum grande glabrum var. nov. PLATE 8, FIGURES 15, 16.

This variety is much like the typical form, except that it is entirely smooth, lacking the punctate character of the former. It is slightly smaller than the typical form and is at once distinguished from var. *rotundatum* W. & G. S. West which differs from it in shape.

The zygospore of our variety is considerably different from that of the typical form. It is of about the same size, but much less angular and more densely set with shorter and more slender spines.

Figure 15 shows an early stage in the formation and *figure 16* the completed zygospore.

Lat. cell. 55–62 μ, lat. zyg. s. sp. 59 μ, c. sp. 84 μ.

This variety was much more frequently found than the typical species in the material collected by Mr. Fisher at Reading, Mass.

Staurastrum polytrichum readingense var. nov. PLATE 8, FIGURES 18, 18*a*.

This variety differs from the typical form in being more densely set with smaller and shorter spines. In other characters it is much the same.

The fruiting condition of this species has, I believe, not been figured. The zygospore of this variety is a peculiar one. It is in the main spherical and is thickly set with spines having a broad base and a trifid apex each portion of which is bifurcated. The whole zygospore including the spines is thickly set with large elongated granules giving a peculiar appearance, especially to the spines. The detail of a single spine showing this condition is given in *figure 18a*.

Lat. cell. 52 μ, lat. isthm. 16 μ: lat. zyg. s. sp. 53 μ, lat. zyg. c. sp. 78 μ.

Found at Reading, Mass.

STAURASTRUM EUSTEPHANUM (Ehrenb.) Ralfs. PLATE 8, FIGURES 19, 19*a*.

The zygospore of this species has, I think, never been figured. It is spherical in form with many processes, fairly wide at base, but on the whole slender. Near the top it divides into three branches, each one of which is again divided and the tips of the divisions bifurcate.

Lat. zyg. s. proc. 45 μ, c. proc. 84 μ.

Found both at Pondville and at Reading, Mass.

Wolle figures three distinct forms of this species. One of these (*pl. 59, figs. 4–6*) is smaller than the typical form with "spreading swallowtail-like ends of processes." This may be called var. **minnesotense** *nobis*. He also figures another variety (*pl. 59, fig. 11*), with elongated processes. This variety may be called var. **Wolleanum** *nobis*.

Explanation of plates 7 and 8

PLATE 7. × 220

FIGURES 1–3. *Closterium Dianae* Ehrenb.
FIGURES 4–6. *Closterium lineatum* Ehrenb.
FIGURES 7, 7*a*. *Micrasterias papillifera* Bréb.
FIGURE 8. *Penium Clevei crassum* W. & G. S. West.
FIGURE 9. *Cosmarium pseudoorbiculatum* sp. nov.
FIGURES 10, 10*a*. *Sphaerozosma readingensis* sp. nov.

PLATE 8. × 450

FIGURE 11. *Staurastrum brevispinum basidentatum* var. nov.
FIGURES 12, 13. *Staurastrum brevispinum* Bréb.
FIGURE 14. *Staurastrum dilatatum* Ehrenb.
FIGURES 15, 16. *Staurastrum grande glabrum* var. nov.
FIGURE 17. *Staurastrum grande* Bulnh.
FIGURES 18, 18*a*. *Staurastrum polytrichum readingense* var. nov.
FIGURES 19, 19*a*. *Staurastrum eustephanum* (Ehrenb.) Ralfs.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1905)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omission their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers, at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card-issue should be addressed to the Treasurer of the Torrey Botanical Club.

Arthur, J. C. *Baeodromus Holwayi* Arth., a new uredineous fungus from Mexico. Ann. Myc. **3**: 18–20. *f. 1, 2.* 28 F 1905.

Bailey, W. W. What winter shows. Am. Bot. **7**: 81–83. [Ja 1905.]

Barnes, C. R. The theory of respiration. Science II. **21**: 241–252. 17 F 1905.

Bartlett, H. H. A new *Juncus* of the group *Poiophylli*. Rhodora **7**: 50, 51. 29 Mr 1905.

J. monostichus sp. nov., from Indiana.

Bayer, A. Beiträge zur systematischen Gliederung der Cruciferen. Beih. Bot. Centralb. **18**[1]: 119–180. *pl. 4, 5.* 1905.

Bessey, E. A. A nematode disease of grasses. Science II. **21**: 391, 392. 10 Mr 1905.

Blanchard, W. H. The bear blackberry. Am. Bot. **7**: 85–87. [Ja 1905.]

Brown, N. E. *Cotyledon elegans*. Curt. Bot. Mag. IV. **1**: *pl. 7993*. 1 Ja 1905.

Native of Mexico.

Christman, A. H. Sexual reproduction in the rusts. Bot. Gaz. **39**: 267–275. *pl. 8.* 18 Ap 1905.

Cogniaux, A. *Orchidaceae* — IX. Flora Bras. 127: 197–390. *pl. 43–79.* 1 Mr 1905.
There are new species in *Dipteranthus*, *Gomeza*, and *Oncidium* (3).

Conard, H. S. The Olympic Peninsula of Washington. Science II. 21: 392, 393. 10 Mr 1905.

Conard, H. S. The waterlilies: a monograph of the genus *Nymphaea*. i–xiii. 1–279. *pl. 1–30* + *f. 1–82.* Washington, 1905.
Carnegie Inst. Wash. Publ. No. 4.

Copeland, E. B. *Fungi* esculentes [*sic!*] philippinenses. Ann. Myc. 3: 25–29. 28 F 1905.
Descriptions of 21 new species in 5 genera.

Cushman, J. A. Localized stages in common roadside plants. Am. Nat. 38: 819–832. *f. 1–48.* 10 Ja 1905.

Evans, A. W. Notes on New England *Hepaticae*,—III. Rhodora 7: 52–58. 29 Mr 1905.

Fernald, M. L. An undescribed northern *Comandra*. Rhodora 7: 47–49. 29 Mr 1905.
C. Richardsoniana sp. nov.

Foster, A. S. In a Washington marsh. Am. Bot. 7: 87, 88. [Ja 1905.]

Ganong, W. F. On balls of vegetable matter from sandy shores. Rhodora 7: 41–47. 29 Mr 1905.

Grout, A. J. Mosses with a hand-lens. Second edition, revised, enlarged, and including the hepatics. i–xvi. 1–208. *pl. 1–39* + *f. 1–118* + *f. 1–33.* New York, [Mr 1905.]

Hall, J. G. Vegetative reproduction of *Spiranthes cernua*. Rhodora 7: 49, 50. 29 Mr 1905. [Illust.]

Harper, R. M. Phytogeographical explorations in the coastal plain of Georgia in 1903. Bull. Torrey Club 32: 141–171. *f. 1–5.* 19 Ap 1905.

Haynes, J. A. The angle of deviation from the normal vertical position at which stems show the strongest geotropic response. Am. Nat. 39: 77–85. *f. 1.* 23 Mr 1905.

Hemsley, W. B. *Nicotiana Forgetiana.* Curt. Bot. Mag. IV. 1: *pl. 8006.* 1 Mr 1905.
A new species, native of Brazil.

Hemsley, W. B. *Romneya trichocalyx.* Curt. Bot. Mag. IV. 1: *pl. 8002.* 1 Mr 1905.
Native of California.

Hemsley, W. B. *Yucca guatemalensis.* Curt. Bot. Mag. IV. **1**: *pl. 7997.* 1 F 1905.
Native of Central America.

Holway, E. W. D. North American *Uredineae.* Ann. Myc. **3**: 20–24. 28 F 1905.
Includes new species in *Puccinia* (5) and *Uromyces.*

House, H. D. Two new species of *Convolvulus* from the western United States. Bull. Torrey Club **32**: 139, 140. 19 Ap 1905.

Livingston, B. E. Notes on the physiology of *Stigeoclonium.* Bot. Gaz. **39**: 297–300. *f. 1–3.* 18 Ap 1905.

Lovell, J. H. Color changes in individual flowers. Am. Bot. **7**: 83–85. [Ja 1905.]

Lyon, H. L. The embryo of the angiosperms. Am. Nat. **39**: 13–35. *f. 1–11.* 20 F 1905.

Macbride, T. H. The Alamagordo desert. Science II. **21**: 90–97. 20 Ja 1905.

Macbride, T. H. The Alamagordo desert. 1–15. [1905.]

Metcalf, M. M. Determinate mutation. Science II. **21**: 355, 356. 3 Mr 1905.

Moore, G. T. Applied botany and its dependence upon scientific research. Science II. **21**: 321–333. 3 Mr 1905.

Pearl, R. Note on variation in the ray flowers of *Rudbeckia.* Am. Nat. **39**: 87, 88. *f. 1.* 23 Mr 1905.

Peet, L. H. Trees and shrubs of Central Park. 1–xii. 1–363. New York, [22 Mr 1905.] [Illust.]

Rick, J. *Fungi* austro-americani fasc. II. Ann. Myc. **3**: 15–18. 28 F 1905.

Robinson, B. L. A well marked species of *Sparganium.* Rhodora **7**: 60. 29 Mr 1905.
S. fluctuans sp. nov.

Rolfe, R. A. *Catasetum Christyanum.* Curt. Bot. Mag. IV. **1**: *pl. 8007.* 1 Ap 1905.
Native of Brazil.

Rydberg, P. A. Studies on the Rocky Mountain flora — XIV. Bull. Torrey Club **32**: 123–138. 19 Ap 1905.
With descriptions of 40 new species and varieties in 15 genera.

Sargent, C. S. Trees and shrubs: illustrations of new or little known ligneous plants. (Part IV.) **1**: 151–217. i–v. *pl. 76–100.* Boston, 8 Ap 1905.
Includes new species in *Acer, Oroxylum, Phellodendron, Arctostaphylos* (2), *Dracaena,* and *Pinus* (2).

Sempers, J. F. Fringed gentian notes. Am. Bot. **7**: 91–93. [Ja 1905.]

Shoemaker, D. N. On the development of *Hamamelis virginiana*. Bot. Gaz. **39**: 248–266. *pl. 6, 7.* 18 Ap 1905.

Skan, S. A. *Angelonia integerrima*. Curt. Bot. Mag. IV. **1**: *pl. 7999.* 1 F 1905.
Native of Brazil and Paraguay.

Sprague, T. A. Preliminary report on the botany of Captain Dowding's Colombian expedition. Trans. Bot. Soc. Edinb. **22**: 425–436. 1905.
Descriptions of 32 new species in 24 genera.

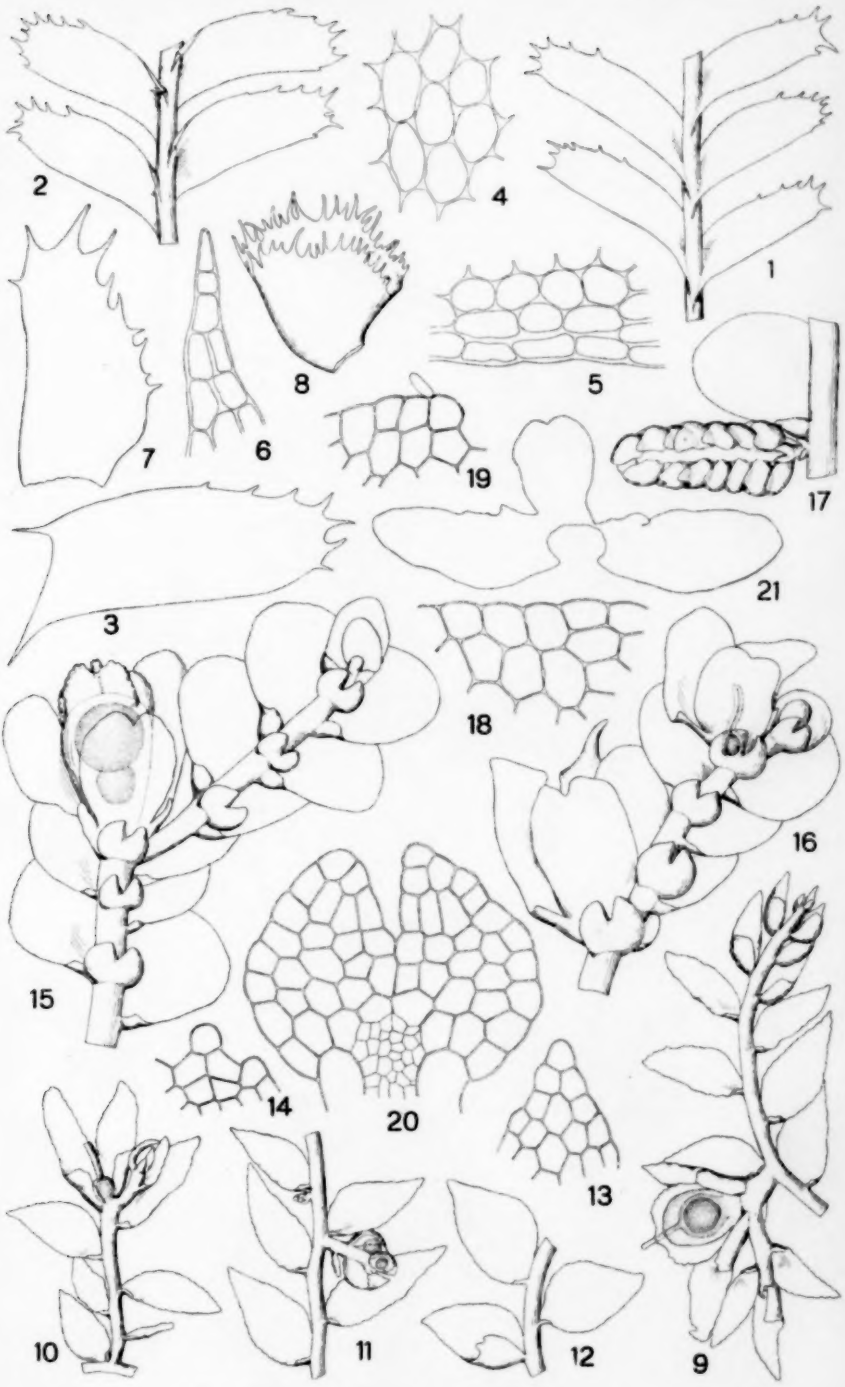
Thaxter, R. A new American species of *Wynnea*. Bot. Gaz. **39**: 241–247. *pl. 4, 5.* 18 Ap 1905.

Trow, A. H. Fertilization in the *Saprolegniales*. Bot. Gaz. **39**: 300. 18 Ap 1905.

Ward, L. F. An example in nomenclature. Science II. **21**: 110. 20 Ja 1905.

Whitford, H. N. The forests of the Flathead valley, Montana. Bot. Gaz. **39**: 99–122. *f. 1–10 + map.* 17 F 1905; 194–218. *f. 11–17.* 20 Mr 1905; 276–296. *f. 18–23.* 18 Ap 1905.

Wright, C. H. *Aechmea lavandulacea*. Curt. Bot. Mag. IV. **1**: *pl. 8005.* 1 Mr 1905.
A new species, native of Grenada, West Indies.

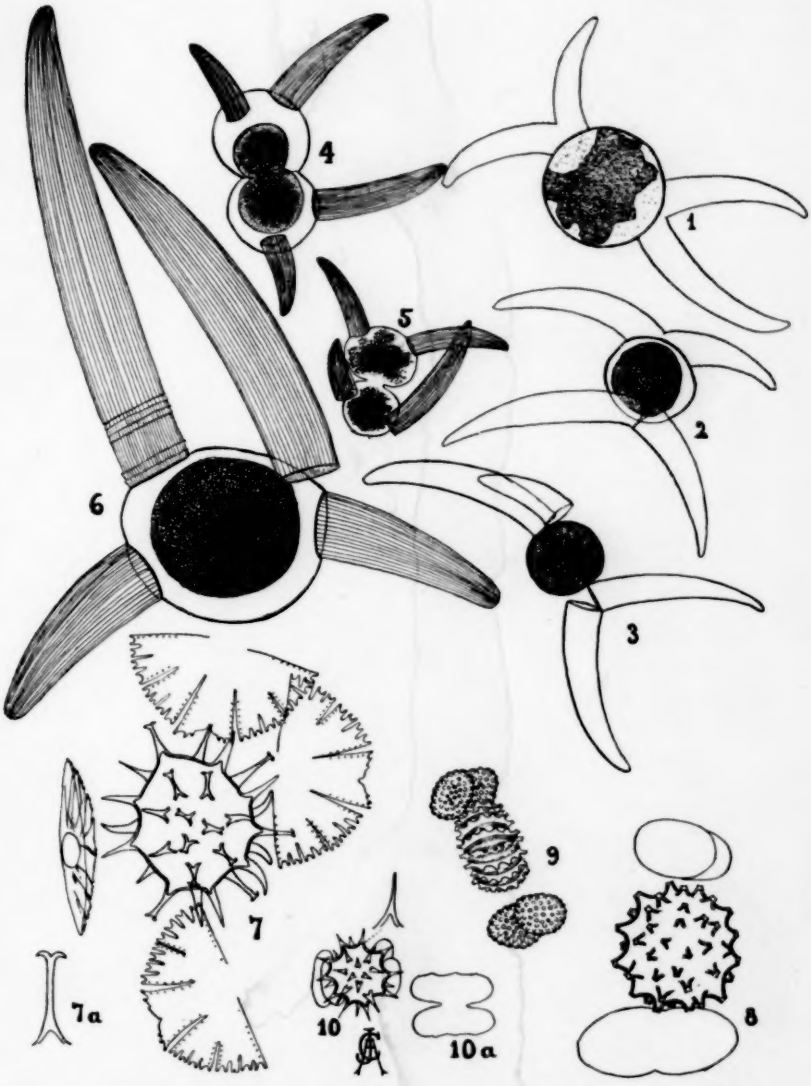


1-8. PLAGIOCHILA SMALLII Evans.

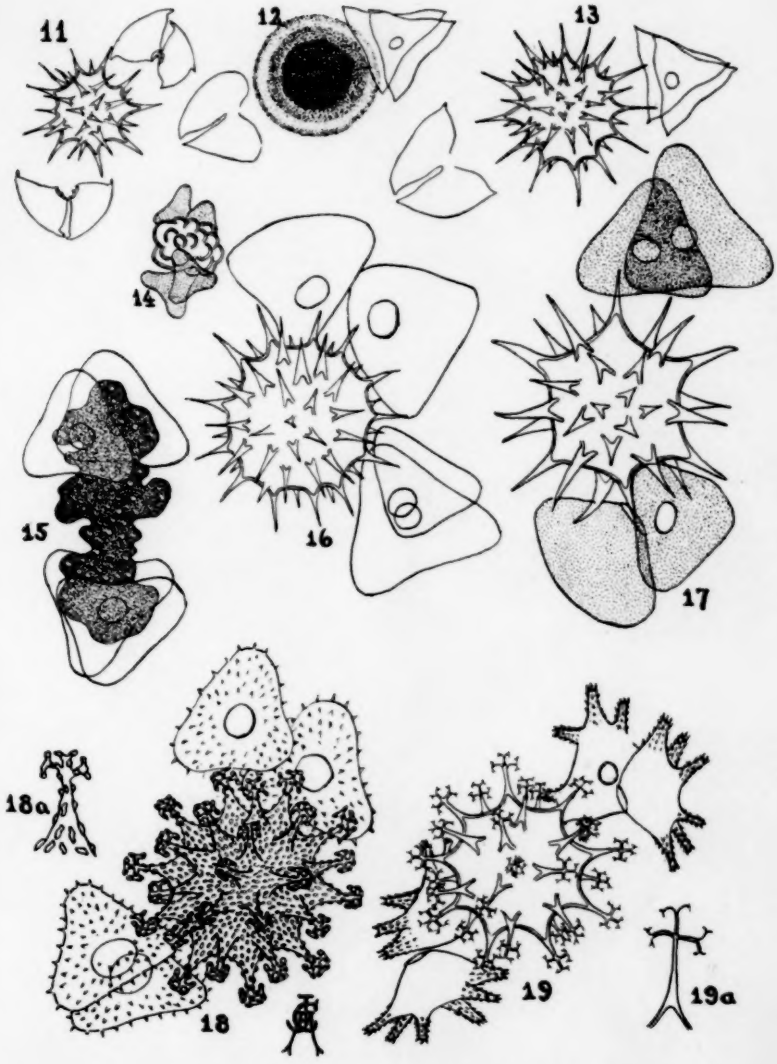
9-14. COLOLEJEUNEA DIAPHANA Evans.

15-21. LEJEUNEA FLORIDANA Evans.

BOTRYCHIUM UNDERWOODIANUM Maxon.



ZYGOSPORES OF NEW ENGLAND DESMIDS



ZYGOSPORES OF NEW ENGLAND DESMIDS